US Fish and Wildlife Service

Draft Environmental Assessment to Permit Take as Provided Under the Bald and Golden Eagle Protection Act for the West Butte Wind Project, Oregon

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Executive Summary

The U.S. Fish and Wildlife Service, Pacific Region, (we, or the Service) has prepared this Draft Environmental Assessment (DEA) to address an application for a Programmatic Golden Eagle take permit. The application was received from West Butte Wind Power LLC, a company developing a wind energy generation facility in central Oregon. The Service has worked cooperatively with the developer, the Bureau of Land Management, and other parties over the past several years on the development of an Avian and Bat Protection Plan (ABPP) and Eagle Conservation Plan (ECP). These plans are the foundation of responsible wind-energy-project development, and form the cornerstone of the Golden Eagle programmatic permit process.

In this DEA we describe the project, the permit application, and the authorities under which the Service is acting on the application. It details the current status of Golden Eagles in and around the project area, considers three permitting alternatives and their associated impacts, and describes the application of avoidance and minimization criteria as well as compensatory mitigation commitments agreed to by the project developer. The Service uses this information to determine whether or not issuing a programmatic Golden Eagle take permit for this project is compatible with the Service's eagle preservation standard under the Bald and Golden Eagle Protection Act.

This is the first programmatic eagle take permit application that the U.S. Fish and Wildlife Service has received, and this Environmental Assessment is the first analysis of such a permit that the U.S. Fish and Wildlife Service has undertaken.

Chapter 1: Purpose and Need for the Action

1.1 Introduction

The U.S. Fish and Wildlife Service (Service or we) received an application for a Programmatic Golden Eagle Take Permit (permit) from West Butte Wind Power LLC (WBWP or applicant) on May 12, 2011. The application is for the WBWP project (project) which is a 104 megawatt (MW) project located in Crook and Deschutes Counties, Oregon. The applicant requests a permit for the legal take of "1 to 2 Golden Eagles over the 20 to 30 year life of the project." The application includes an ABPP and ECP. The ECP is intended to avoid, minimize and mitigate adverse effects on eagles, and was developed in collaboration with the Service.

The project proponent conducted a risk assessment analyzing the anticipated impacts of the project on eagles based on the results of their site-specific surveys (Gerhardt et al. 2008, Gerhardt et al. 2010). Their risk assessment uses lack of eagle detection from surveys, low prey abundance and availability, and topography to support their prediction that this project would result in the mortality of 1 to 2 Golden Eagles over its 20- to 30-year life; they substantiate this further by stating that they have sited their project away from significant breeding areas, major migration routes, concentration areas, important wintering areas, communal roosts, and primary foraging areas. They explain that the risk of eagle fatalities from this project will be low compared to other projects in the Region for these reasons. The Service conducted its own Golden Eagle Fatality Prediction for the WBWP, which predicted the take of 0-17 eagles over the project's 20- to 30-year life. The result and revised fatality prediction are in Chapter 4 of this DEA. The complete Service's Risk Assessment can be reviewed in Appendix 3 of this DEA.

This DEA will describe the project and the application; the authorities under which the Service is acting on the application; and analyze three alternatives and their expected direct, indirect and cumulative impacts on the human environment to satisfy the Service's obligations under the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 *et seq*.).

1.2 Background

WBWP is proposing to construct and operate a wind energy generation facility. The proposed project is located on top of West Butte and its immediate ridges to the east, approximately 30 miles south of the city of Prineville and 30 miles east of the City of Bend. The project will consist of 45 to 56 wind turbine generators ranging from 2.0 to 3.0 megawatt (MW) each. Each turbine will be approximately 400 to 430 feet in total height from the foundation to the blade tip, depending on the type of generator selected. Construction of the project is scheduled for 2012 and expected to become fully operational in late 2012.

Although the WBWP will be built on private land, access to the site is via a road that crosses land owned by the Bureau of Land Management (BLM). WBWP applied to BLM for a Right of Way (ROW) permit to access the site, improve the road, and build transmission lines for power generated at West Butte. BLM analyzed the effects of their permit action in an Environmental

Impact Statement (EIS) (DOI – BLM – OR- P060-2009-0064-EIS) (BLM 2010a). The effect of granting a ROW permit allows the project to be built. BLM examined the environmental effects of this new wind-power project on many aspects of the human environment in its EIS, and we refer to some of those analyses in this document. Our analyses address the expected impacts on the human environment, with a focus on eagles and migratory birds, from our permitting decision.

The Service began working with the applicant to develop an Avian and Bat Protection Plan in July 2010. In January 2011, the Service issued the Draft Eagle Conservation Plan Guidance (Draft Guidance) (USFWS 2011a), which is intended to assist industry in avoiding and minimizing impacts to eagles that might result from site selection, construction, operation, and maintenance of land-based, wind energy facilities. It should be noted that the Draft Guidance is undergoing revision and will likely continue to be modified in the future to incorporate new methods, technologies, and information that relates to eagles and renewable energy. The Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. § 668a) prohibits the "taking" of an eagle which includes killing, harassing, or disturbing, the birds or their nests unless permitted, and is the legal foundation of the Draft Guidance.

The Draft Guidance also was developed to help project developers, Service employees, and other agencies interpret and implement the 2009 Eagle Permit Rule (50 CFR 22.26). Before the Service will issue an eagle programmatic take permit, a project developer must submit an application that meets the regulatory issuance criteria outlined in 50 CFR 22.26 and that is compatible with the preservation of eagles as required by the BGEPA, including:

(1) Avoid and minimize take to the maximum degree achievable;
(2) Conduct adequate post construction monitoring to determine effects;
(3) Offset through compensatory mitigation any remaining take, such that the net effect on the eagle population is, at a minimum, no change for eagle management populations that cannot sustain additional mortality;
(4) Ensure that the direct and indirect effects of the take and required mitigation, together with the cumulative effects of other permitted take and additional factors affecting eagle populations, are compatible with the preservation of Bald Eagles *(Haliaeetus leucocephalus)* and Golden Eagles (*Aquila chrysaetos*).

To assist project proponents in meeting the requirements of 50 CFR 22.26 outlined above, the Guidance outlines a five-stage approach to developing successful ECPs. These five stages are:

(1) Initial landscape-scale site assessment;
(2) Site-specific surveys and assessment;
(3) Fatality prediction;
(4) Application of Advanced Conservation Practices (ACPs) that avoid and minimize risk, and application of compensatory mitigation for remaining unavoidable take;
(5) Post-construction monitoring.

On March 15, 2011, the Service received WBWP's final ECP (Appendix 1). The Service then conferred with BLM in regard to their Instruction Memorandum (IM) Number 2010-156 (BLM 2010b). Among other things, this IM requires interagency coordination between BLM and the Service to assure that any conservation plan (termed APP in the IM) developed to address eagle conservation is sufficient to meet the conservation standards in the BGEPA and its implementing regulations. It further requires a Letter of Concurrence regarding "…the adequacy of the APP." To address this interagency coordination, the Service issued a Letter of Acknowledgement for WBWP on April 29, 2011, stating that the ECP is consistent with the Draft Guidance and the provisions of the Eagle Rule (50 CFR 22.26). Our review of the ECP resulted in categorizing the project as—Category 2—'high to moderate risk to eagles but there are opportunities to mitigate the impacts' (USFWS 2011a). The Service subsequently received a complete permit application on May 12, 2011.

1.3 Purposes and Need for Action

An objective of the Service is to maintain stable or increasing breeding populations of eagles (USFWS 2009a) protected by the BGEPA. Regulations under the BGEPA allow us to issue permits for activities that are likely to take eagles provided that the activity is otherwise lawful and the taking is not the purpose of that activity, the take is unavoidable even though advanced conservation practices are being implemented, and is compatible with eagle preservation (50 CFR 22.26). The development of this project does pose an unavoidable risk to eagles and is as yet unpermitted for that take. Thus, our purpose is to evaluate the environmental impacts of the permitting action—including implementation of the applicant's proposed Eagle Conservation Plan and Avian Protection Plan—and the alternatives presented.

The primary need for this analysis is to consider and take action on the permit application in accordance with BGEPA statutory requirements and implementing regulations described in 50 CFR 22.26. The Service also has obligations to consider the effect of its actions on other migratory birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703-712) (MBTA), and in accordance with Executive Order 13186, which compels Federal agencies to consider the effects of their actions on birds, particularly to Birds of Conservation Concern (USFWS 2008). In taking action on the permit application, the Service must specifically consider the following: 1) The Service has an obligation to respond to the applicant's request for a permit for programmatic take of Golden Eagles protected under BGEPA, 2) the Service must ensure that the take under BGEPA is compatible with the preservation of eagles, and (3) the Service must ensure compliance with BGEPA and other Federal laws and regulations. Thus, this Draft EA (DEA) will analyze the effect on eagles and other aspects of the human environment from alternatives associated with this permit action.

1.4 Authorities

The primary Federal authority applicable to the action analyzed in this DEA is BGEPA. The Service is the Federal agency with primary statutory authority for managing Bald and Golden Eagles in the United States. Limited take of Bald and Golden Eagles is authorized in 50 CFR 22.26. BGEPA's implementing regulations define "take" as "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb individuals, their nests and eggs"

(50 CFR 22.3). “Disturb” is defined by regulation at 50 CFR 22.3 as “to agitate or bother a bald or golden eagle to a degree that causes….injury to an eagle, a decrease in productivity, or nest abandonment …” (USFWS 2007). Service policy on the use of Guidance for evaluating an Eagle Take Permit application’s consistency with 50 CFR 22.26 was outlined in a March 15, 2011, letter from the Acting Director of the Service to the Regional Directors (USFWS 2011b). Regulations under 50 CFR 22.26 distinguish take that might result from short-term or one-time actions from take that results from ongoing long-term actions (programmatic take). WBWP potentially will result in one or more eagle mortalities caused by ongoing activities over the life of the project, so the appropriate permit type is the programmatic permit.

The Service will authorize take of Bald or Golden eagles only if we have determined that the take (1) is compatible with the preservation of Bald and Golden eagles and (2) meets the criteria for issuance of a programmatic permit that take has been avoided to the maximum degree achievable. For purposes of 50 CFR 22.26, “compatible with the preservation of Bald or Golden eagles” means “consistent with the goal of stable or increasing breeding populations.” Although the biologically-based take thresholds for permitting under these regulations will be based on regional populations as defined by the Final Environmental Assessment supporting the regulations (USFWS 2009b), we will also consider other factors, such as cultural significance, that may warrant protection of smaller or isolated populations within a region. The subject of this DEA is an assessment of the environmental impacts of the various alternatives, including whether those alternatives meet the permit issuance criteria under points 1 and 2 above.

The MBTA provides the Service with the regulatory authority to protect nearly all species of birds native to the United States (50 CFR 10.13). Thus, our analysis takes into account the effects of a permit action on other species of birds as well as eagles. For eagle take, a separate authorization under the MBTA is not required. Many impacts to eagles that will require BGEPA authorization will not “take” eagles under the MBTA because that statute does not contain a prohibition against disturbance (without injury) of the birds it protects. Therefore, activities that disturb an eagle will not require MBTA authorization. Even where MBTA take will occur, e.g. actions that result in injury or harm to eagles, a separate MBTA authorization in addition to the Eagle Act authorization is not required because 50 CFR 22.11(a) exempts those who hold Eagle Act permits from the requirement to obtain an MBTA permit. A full list of the applicable authorities under which the Service is conducting this action is found in Appendix 2.

1.5 Scope of Analysis

This DEA evaluates the effects of three alternatives for issuing a permit to take Golden Eagles under the Eagle Act. These alternatives have potentially different effects on Golden Eagles, and on other aspects of the human environment. The human environment includes Golden Eagle populations, migratory bird and bat populations, human safety, the economy, cultural values, and Native American religious and cultural practices. The geographic scope of the analyses is at the ‘local project level’, which is the actual footprint of the project out to a distance of 10 miles, and at the ‘regional level’ which includes all or parts of two Bird

Conservation Regions, the Northern Rockies and the Great Basin Bird Conservation regions (BCR 10 and BCR 9, respectively) (NABCI 2011) (Figures 1). In addition, we consider effects at the local population level, which the Service has defined as the average distance that young disperse from nests; that distance is 140 miles for Golden Eagles (USFWS 2009a).

In the analysis of alternatives, we also consider the degree to which the applicant addressed the five-stage process outlined in the Draft Guidance, with the recognition that there is no regulatory or legal requirement to meet the criteria of the Guidance and that the applicant still must meet their obligation to qualify for an eagle take permit under 50 CFR 22.26. These stages are briefly described below. The project's ECP should document how a wind project's siting, design, and planned operation will achieve the following: 1) minimization and avoidance of Golden Eagle take to the maximum degreed achievable; 2) application of any necessary advanced conservation practices to reduce Golden Eagle take to that which is unavoidable; and 3) implementation of any compensatory mitigation necessary to result in no net loss of eagles or even a net conservation benefit at the BCR scale.

Stage 1 - Site assessment

The objective of the Stage 1 site assessment is to broadly look at the landscape of interest and identify, based on existing information and studies, known or likely important eagle-use areas. Based on that information, project proponents work with the Service to place potential wind facility sites in one of the four site categories: Category 1—high risk to eagles, potential to avoid or mitigate impacts is low; Category 2—high to moderate risk to eagles, opportunity to mitigate impacts; Category 3—minimal risk to eagles, unlikely to have eagle within 10 miles of the project footprint; Category 4—uncertain risk to eagles, site lacks sufficient data to assign a category.

Stage 2 - Site-specific surveys and assessments

Detailed, site-specific information is collected on the use by eagles of a potential wind project site (eagle use). The information collected in Stage 2 is used to generate predictions of the annual number of eagle fatalities for a wind facility site and to identify important eagle-use areas likely to be affected by the project.

Stage 3 - Predicting eagle fatalities

The project proponents work in coordination with the Service to determine risk factors associated with the facility and develop an annual predicted eagle mortality rate for the project.

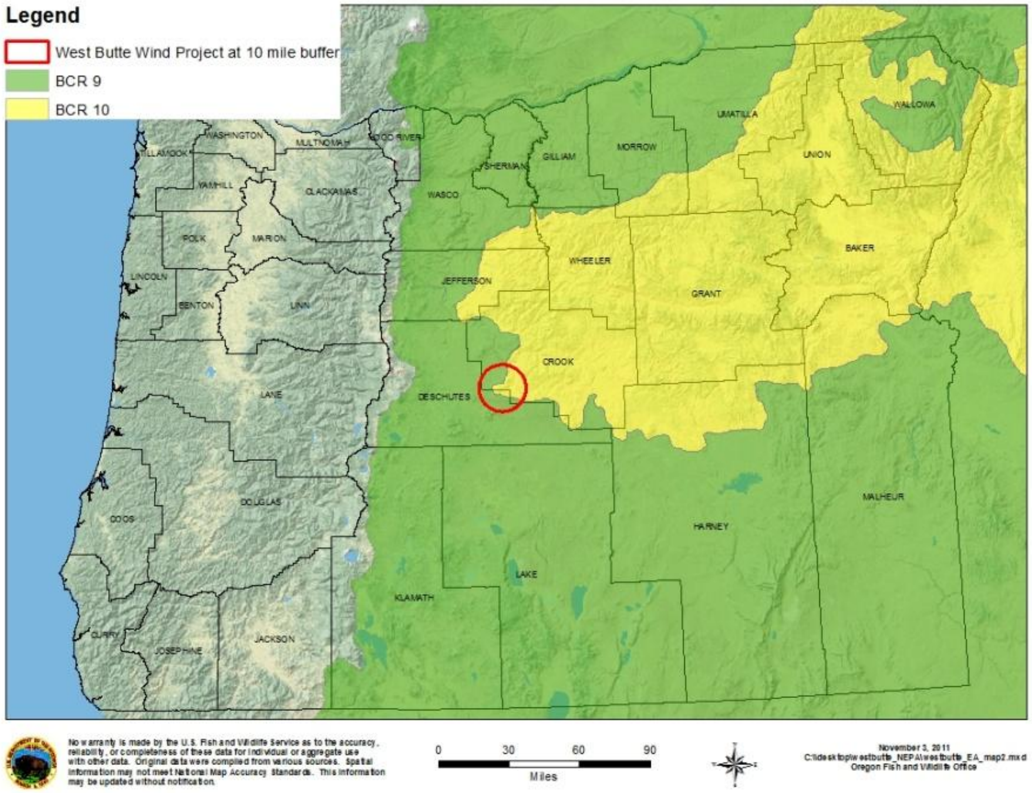

Figure 1: The West Butte project plus a 10-mile circle around it, relative to BCRs 9 and 10.

Stage 4 - Avoidance and minimization of risk using ACPs, and compensatory mitigation

Siting of a wind facility is the most important factor when considering potential effects to eagles. Stage 4 provides opportunity to apply additional advanced conservation practices (ACPs) to avoid and minimize eagle risk to the maximum degree achievable such that any remaining take is unavoidable. These ACPs include commitments to adaptive management. Current Golden Eagle population data necessitates that, for any remaining unavoidable take, compensatory mitigation must be applied until the project achieves, at a minimum, no net reduction in the breeding eagle population at the BCR scale.

Stage 5 – Post-construction monitoring

The project proponent implements a post-construction survey to estimate the following:

(1) The annual number and circumstances causing eagle fatalities at the wind facility; and
(2) The disturbance effects on eagle territories close to operating wind facilities.

Post-construction monitoring is essential to identify possible factors associated with eagle fatalities at wind facilities that might warrant additional ACPs or improvement or elimination of ACPs found to be ineffective. Implementation of these additional ACPs and further monitoring following identical (though perhaps more targeted) protocols will help the Service and project proponents rigorously evaluate the effectiveness of the ACPs under the project's operating conditions.

1.6 Scoping and Public Participation

This DEA is being made available to the public for a 30-day comment period until February 2, 2012. In addition, this document has undergone internal vetting among Service divisions regionally and nationally.

1.7 Tribal Trust Responsibilities

Tribal participation is an integral part of the NEPA process, and in determining whether to issue a permit to authorize take of Golden Eagles within this defined project area. In accordance with Executive Order 13175 and the Service's Native American Policy, the Service consults with Native American tribal governments whenever our actions taken under authority of the Eagle Act may affect tribal lands, resources, or the ability to self-govern.

The Service has initiated consultation on this project through a consultation letter sent to sovereign nations of the Confederated Warm Springs Tribes, Klamath Tribe, and Burns Paiute Tribe, informing them of receipt of the eagle take permit application and preparation of this DEA. Consultation with these tribal governments will be ongoing throughout this analysis and permitting process.

Chapter 2: Alternatives

2.1 Introduction

This chapter introduces three alternatives that provide a range of reasonable alternatives for responding to the WBWP's application under 50 CFR 22.26 and for evaluating impacts to Golden Eagles expected to be caused by the project. The alternatives considered include: (1) No action, (2) issue permit as requested, and (3) issue permit with additional conditions.

2.2 Alternative Considered But Eliminated From Detailed Study

Issue a 30-Year Permit – Under current regulations, the programmatic eagle take permit has a 5-year term and is renewable. A longer-term permit (for up to 30 years) may be available in the future, but this will require a rule making by the Service to change 50 CFR 22.26. This might be an option for the developer in coming years. Currently, however, this alternative is not an option and does not meet our purpose and need for this action. We do not analyze this alternative further.

2.3 Alternative 1: No Action

Under the No Action alternative, we would deny the permit application and not issue a permit. We consider this alternative because we are required under NEPA to analyze a No Action alternative and, in this case, not issuing the permit is one of the potential responses to a permit application. We rejected consideration of a separate alternative of not even responding to the permit application (literally taking no action) because it is the expectation of the public and our legal obligation to respond to all permit applications in a timely manner without unreasonable delay (see 5 USC 706(1)).

Under this alternative, the Service would not issue the eagle take permit either because the Service feels that take of eagles is unlikely and a permit to allow take is, therefore, unnecessary, or because the application and conservation commitments made by the applicant in the accompanying ECP failed to meet any one of the several issuance criteria described under 50 CFR 22.26.

2.4 Alternative 2: Issue Standard 5-year Permit

Under this alternative the Service would issue a permit to take a specific number of eagles with associated conditions, as allowed by regulation. The 5-year permit would incorporate all conservation commitments described in the ABPP and ECP (see Appendix 1), including Golden Eagle surveys, adaptive management measures, compensatory mitigation measures, and a conservation commitment prior to construction, plus any other measures deemed appropriate by FWS. The permit may be renewed after the initial 5 years, pending review by the Service. That review and every subsequent 5-year permit reissuance would include an evaluation of eagle take at the project site, the effectiveness of adaptive management measures implemented, and the results of any additional monitoring of the local-area eagle population, which includes on-site, daily monitoring by project staff for the duration of the project, plus NEPA analysis.

This alternative would include provisions to enable the Service and the applicant to work to minimize long-term impacts to eagles before the permit was issued, during the permit term, and prior to renewal.

2.5 Alternative 3: Issue 5-year Permit with Additional Conditions

Under this alternative the Service would issue a Programmatic Eagle Take Permit for a specific number of eagles but with additional conditions that address monitoring, research, habitat creation, and mitigation that might further reduce take; by regulation (50 CFR 13.21(e)), conditions may be added to all permits the Service issues. These could include, but are not limited to, commitments to experiment with real-time radar systems designed to detect approaching birds and shut turbines down prior to collision; monitor mortalities at every turbine using biologists contracted for this purpose; institute and fund research on factors that affect collision rates of eagles at West Butte or other sites with higher eagle use; and engage in habitat improvements. The permit would include all of the commitments to conservation and monitoring in the existing permit application, plus any additional measures deemed appropriate (50 CFR 13.21(e)). The permit may be renewed after the initial 5 years, pending review by the Service. That review and every subsequent 5-year review would include an evaluation of eagle take at the project site, the effectiveness of adaptive management measures, and the results of any additional monitoring of eagles in the project area which may include life-of-project mortality monitoring by a third-party consultant.

Chapter 3: Affected Environment

3.1 Introduction

The project area is located almost entirely in southwest Crook County, Oregon, with the main access road primarily in Deschutes County. The project is situated north of Highway 20, 32 miles east of Bend, Oregon, and is located on the land formation known as the Bear Creek Buttes. The majority of the project is on West Butte itself (Figure 1). West Butte is located between three distinct habitat types occupied by Golden Eagles. These include agricultural lands to the northwest, canyons and bluffs along the Crooked River to the north, and the Great Basin Eco-region to the east and south.

3.2 Physical Environment

The project site is located entirely on open rangeland, which is zoned exclusively for farm use by Crook and Deschutes Counties. The habitat is primarily shrub-steppe, with sagebrush and grassland throughout, but there is a large, and increasing, western juniper (*Juniperus occidentalis*) component. Historically, juniper was likely confined to the draws and protected rimrock areas, with periodic wildfires preventing it from establishing on upland habitat. Much of the juniper currently found within the project area is relatively young, a fact that suggests recent encroachment facilitated by fire suppression (Gerhardt 2011).

Ponderosa pine is sporadic on the project area, except in two places where rather large stands can be found. Spring-fed streams are small, and no riparian systems exist to interrupt the shrub-steppe habitat. Topographic relief exists primarily in the form of rolling hills, and some of the draws between the hills carry water from late winter and spring snowmelt. West Butte rises above the surrounding landscape, but its topography lacks cliffs, steep slopes, or rim rock. Soil coverage on the top of the butte is thin due to high wind erosion and exposed fractured basalt. West Butte and other ridges in the project area are approximately 5,000 to 5,700 feet in elevation.

3.3 Biological Environment

3.3.1 Bald Eagle - General Conditions, Population, local status

<u>General Conditions</u>

Bald Eagles may occur within the project area during the summer and winter months (BLM 2010). Bald Eagles in eastern Oregon are known to hunt in upland habitats for carrion and small mammals (Gerhardt 2011). Bald Eagles typically nest near permanent aquatic habitats, including lakes, rivers, and reservoirs. The nearest water feature to the project is the Prineville Reservoir located more than 10 miles northeast of West Butte.

Population

Information from eagle experts in the area identified two active Bald Eagle nests seven to ten miles north of the West Butte project. One of the nests is located near North Alkali Flat at Prineville Reservoir. The second nest is a relatively new site along the Crooked River. This new nest produced one chick in 2011, and is approximately 9 to 10 miles from the project (Isaacs 2011, pers. comm).

Local Status

The project consultants, Northwest Wildlife Consultants, conducted raptor nest surveys within 2 miles of the project. No Bald Eagle nests were detected during this survey. Bald Eagles may fly over the project area, and could potentially be found foraging on road kill on Hwy 20 during the winter months or in alfalfa fields approximately 5 miles to the north.

3.3.2 Golden Eagle - General Conditions, Population, Local Status

General Conditions

Golden Eagles primarily nest in mountain cliffs or canyons. In the western United States their nesting habitat is often associated with rim-rock terrain adjacent to open desert or grasslands. Cliff nests are more common throughout most of North America, while tree nests are more common in the northeast (Kochert *et al.* 2002). Mountain cliff and canyon features suitable for Golden Eagle nesting are not present in the project area.

Golden Eagles nest in a wide variety of trees, including ponderosa pine (*Pinus ponderosa*) (Phillips and Beske 1990). The project area contains a few large ponderosa pine trees. Two of the pine trees contained historical Golden Eagle nests. Both nests are within 2 miles of the project boundary. One of the nests was active in 2010 (West nest) and the other nest was destroyed during a recent BLM prescribed burn (referred to as the North nest). These two nest sites may reflect separate territories or possibly a single Golden Eagle territory because the nests were about 1.25 miles apart.

The number of Golden Eagle nests per territory can range from 1 to 14, but is generally 2 to 3 (Kochert et al. 2002). Alternate nests can be up to 5 kilometers apart within a territory (McGahan 1968). Moreover, some nests are never actually used and may persist on the landscape for decades. Nest site selection and productivity of Golden Eagles is associated with proximity to concentrations of prey (Kochert et al. 2002).

High raptor-collision rates at some wind farms (example, Altamont Pass wind facility as cited in NWCC, 2010) often correlate with high raptor use, which in turn correlates with high density of small mammal prey and conditions favorable to high prey densities (BLM 2010, Smallwood and Thelander 2004, Smallwood and Thelander 2008). Abundance and densities of prey at the

WBWP have not been studied well, but observations by the project suggest that prey abundance and density on West Butte is not sufficient to support breeding Golden Eagles (Gerhardt 2010a). However, prey species such as ground squirrel (*Spermophilus* spp.), Greater Sage-Grouse (*Centrocercus urophasianus*), black-tailed jackrabbit (*Lepus californicus*), and cottontail rabbit (*Sylvilagus bachmani*) all occur both on the proposed project area as well as at lower elevations surrounding West Butte (BLM, 2010). In a study of Golden Eagles in central Oregon, the primary prey species were black-tailed jackrabbits, other medium to large mammals, and some larger birds (Gerhardt 2000).

<u>Population</u>

Golden Eagles are distributed throughout the Northern Hemisphere primarily between 20° and 70° N latitudes (Watson 1997). In North America, the species is most abundant west of 100° W longitude from the arctic slope to central Mexico (Kochert et al. 2002). Golden Eagles have been observed throughout Oregon, and nesting has been documented or was suspected in all counties except Hood River east of the Cascades and in 9 of 18 counties west of the Cascades (Isaacs and Opp 1991, Carey 2003, Isaacs and Anthony 2011).

Studies from 1966 to 1980 in southeastern Oregon correlated Golden Eagle nesting success with black-tailed-jackrabbit abundance (Thompson et al. 1982); other studies suggest a considerable Golden Eagle population decline in central Oregon from 1966 to 1984 (Anderson 1985, Kochert and Steenhoff 2002); and still others indicate a decline in the Golden Eagle breeding population along the lower Deschutes River in north-central Oregon between 1995 and 2001 (Clowers 2001).

Despite historical data and survey efforts, the size, distribution, and productivity of Golden Eagles nesting in Oregon has not been determined and statewide trends most likely have changed and are currently unknown (Isaacs and Anthony 2011). The breeding population of Golden Eagles in Oregon was estimated at 1,000 to 1,500 nesting pairs in the mid-1980s, however that estimate was based on limited and inconsistent monitoring and rough estimates from areas surveyed, therefore population trends could not be determined (Isaacs and Opp 1991). The only annual data on the Golden Eagle population in Oregon are from the Western Ecosystems Technology, Inc. (WEST) surveys (see discussion below). A population survey in Oregon was undertaken in 2011 and will continue in 2012.

<u>Population Status in BCR 9 and 10; Relationship to Project Area</u>

The project is located at the extreme western edge of BCR 10. Included in BCR 10 are the northern Rocky Mountains and outlying ranges in both the United States and Canada, and also the intermontane Wyoming Basin and Fraser Basin. The Rockies are dominated by a variety of coniferous forest habitats. Drier areas are dominated by ponderosa pine, with Douglas-fir and lodgepole pine at higher elevations, and Engelmann spruce and subalpine fir even higher. More mesic forests to the north and west are dominated by western larch, grand fir, western red cedar, and western hemlock. The Wyoming Basin and other lower-lying valleys are characterized by sagebrush shrubland and shrubsteppe habitat, much of which has been degraded by conversion to other uses or invasion by nonnative vegetation.

BCR 9 is within 10 miles of the project area. The effects analysis overlaps this BCR and is included in this DEA. BCR 9 is a large and complex region that includes the Northern Basin and Range, Columbia Plateau, and the eastern slope of the Cascade Range. This area (slightly west of the project) is dry due to its position in the rain shadow of the Cascade and Sierra Nevada mountain ranges. Grasslands, sagebrush (*Artemisia spp.*), and other shrubs typical of western arid landscapes dominate the flats and lowlands, with piñon pine (*Pinus edulis*) and juniper woodlands and open ponderosa pine forests on higher slopes. Lodgepole pine (*Pinus contorta*) and sub-alpine fir (*Abies lasiocarpa*) forests occur at higher elevations on north-facing slopes.

The Service collects baseline data on the number of Golden Eagles in the western United States in order to assess the magnitude and potential effects of threats to Golden Eagle populations. In 2003, the Service contracted with WEST Inc. to help design and conduct a range wide survey of Golden Eagles across the western United States. The study area included BCRs 9 (Great Basin), 10 (Northern Rockies), 16 (Southern Rockies / Colorado Plateau), and 17 (Badlands and Prairies) within the United States (Figure 2). These regions include much of the western United States and habitat types ranging from low-elevation sagebrush and grassland basins to high-elevation coniferous forests and mountain meadows.

The data from the WEST surveys for BCR 10 (Nielson et al. 2011) are presented in Table 1 below. The WEST surveys represent individual Golden Eagle observations, independent of nests.

Table 1: Estimated population totals (all ages and juveniles) of Golden Eagles in BCR 10 in 2006–2010 (excluding military lands, elevations greater than 10,000 feet, large water bodies and large urban areas). (90% confidence intervals in parentheses.)

Year	BCR 10: Northern Rockies (*ALL AGES)*	BCR 10: Northern Rockies (*JUVENILES)*
2006	6074 (3594–9116)	1519 (731–2524)
2007	7150 (4102–11209)	1091 (164–2214)
2008	7433 (5039–10387)	1014 (549–1565)
2009	7185 (4455–10873)	1123 (447–1962)
2010	7554 (4831–10961)	573 (5*–1300)

**Lower limits set to number observed during the survey.*
Estimates for 2006 – 2010 were obtained by pooling observations across years to improve estimates of detection probabilities. Thus, estimates for 2006–2009 have been updated and are slightly different from those presented in previous reports (Nielson et al. 2011).

There is no significant trend in the total numbers (all age classes combined) of Golden Eagles observed in BCR 9 and 10 during 2006 through 2010. However, there was a statistically significant decline in the total number of juvenile Golden Eagles observed in BCR 10 during this period.

Golden Eagle Nesting Population within 10 Miles of the Project

The project area nesting population is defined as the number of territories within a 10-mile radius from the project footprint. (The exact definition of project footprint is in USFWS (2011b), but is essentially the area that encloses all of the turbines and any associated infrastructure such as utility lines, outbuildings, roads, etc.)

Limited historical information is available regarding the project area nesting population of Golden Eagles. In 2008, an independent raptor nest survey was conducted at the project area; two inactive Golden Eagle nests were identified within 2 miles of the project boundary (Gerhardt and Griski 2008). A helicopter nest survey occurred in 2009 using a qualified avian ecologist and a helicopter pilot experienced at conducting these types of surveys. These surveys covered the project area and a two-mile buffer around the turbine strings and access road. They did not detect eagles (Gerhardt et al. 2010); however, these surveys occurred in late May, only surveyed out 2 miles and therefore may have missed a failed breeding attempt that season.

In 2010, both of the historical Golden Eagle nests were monitored from the ground. As noted above, during fall 2009 one of the known nest trees (North nest), located a quarter mile from the project, died after a controlled burn and is no longer a viable Golden Eagle nest site. At the remaining nest approximately 1.8 miles SW of the project boundary (West nest), there was an adult on the nest on April 1 and again on May 3. When monitored again on May 25, there were no eagles in the vicinity and no young or eggs in the nest, indicating the breeding attempt failed (Gerhardt, pers. observ.). This nest was surveyed again by Isaacs (2011). No nesting activity was observed by Isaacs, however, a Golden Eagle pair was roosting in a ponderosa pine tree approximately 100 yards from the original nest tree and the nest appeared to be actively maintained.

In 2011, the Oregon Eagle Foundation compiled all previously surveyed historical nest site data from many sources within 10 miles of West Butte. The data search revealed five territories that were "recently active". In 2011, the Oregon Eagle Foundation surveyed four of the five historical nest sites. All four were occupied but failed (Isaacs pers. comm. 2011). Aside from the West nest site, the other four territories are five or more miles from the project footprint. (Two additional territories are approximately 11 to 12 from the project boundary.) The mean inter-nest distance among these five sites is approximately 7.7 miles (Appendix 3).

The non-breeding component of eagle populations includes juveniles (fledged that year), subadults, and, in healthy populations, adult floaters that have not settled on a breeding territory (Hunt et al. 1995, Hunt 1998). Many non-breeding eagles may exist on the margins of territories occupied by breeding adults (Watson 1997, Hunt 1998, Caro et al. 2010). Floaters have been shown to be more vulnerable to collision with turbine blades at wind-energy projects than locally-breeding adults and juveniles (Hunt et al. 1999, 2002). Wind turbines sited close to eagle nesting territories may pose significant risks to eagle populations, because population stability hinges on a robust non-breeding cohort, especially surplus adult floaters, to replace breeding individuals that die. A systematic approach to documenting eagle use within the project footprint has the substantial advantage of accounting for any eagle regardless of its breeding or residency status (USFWS 2011a).

One year of avian-use surveys were conducted in 2008 to determine use within the project boundary. Five 800-meter radius, non-overlapping, avian-use study plots were located within the project area. Plot placement was designed to maximize viewing and provide excellent coverage of the proposed turbine strings as well as varying habitat and topography. Weekly avian-use surveys were conducted for a one-year period. During this year, during a spring survey, a single detection of a Golden Eagle was recorded within the survey plots (Gerhardt et al. 2008). On three occasions, a Golden Eagle was detected outside of the project footprint. Golden Eagles were also documented on four other occasions outside of the project area at lower elevations associated with the access road, rather than on West Butte where turbines are planned, all during the summer. No eagles were observed on site during the winter. The results of these surveys are included as an Appendix within the ABPP and ECP for this project (Appendix 1: West Butte Wind Power Project Final Avian and Bat Protection Plan and Golden Eagle Conservation Plan).

3.3.3 Birds of Conservation Concern within Project Area

The Birds of Conservation Concern (BCC) identify migratory and non-migratory birds within each BCR of the United States and its territories that are of conservation concern so as to stimulate coordinated and proactive conservation actions among Federal, State, Tribal, and private partners. The conservation concerns may be the result of population declines, naturally or human-caused small ranges or population sizes, threats to habitat, or other factors. Several of the species occur within 10 miles of the proposed project. A complete list of BCC species within BCR 9 and BCR 10, including those that occur in or near the project area can be found in Appendix 4.

3.4 Eagle Mortality Associated with Human Activities

According to local biologists, the most probable sources of eagle mortality within the 10-mile radius of the project include: (1) Vehicle strikes due to foraging on road-killed rabbit and mule deer, (2) electrocution from power poles (distribution lines) that do not meet raptors-safe specifications (APLIC 2006), and (3) lead poisoning from bullets and shotgun pellets used by hunters of big game, small mammals, and upland birds (Schmidt, pers. comm). Game that has been shot and left in the field may be scavenged by Golden Eagles. Radiographs of rifle-shot carcasses reveal multiple lead fragments in the meat of these animals, which is then ingested by scavengers (Stauber et al. 2010; Tompkins, personal communication); high lead levels in their tissue increase the risk of lead poisoning in the scavengers (Anderson 2011). According to local wildlife rehabilitators in eastern Oregon, there have been no known eagle deaths from lead poisoning within the area surrounding West Butte however, two coyote carcasses were discovered with high levels of lead poisoning from lead shot along Hwy 20, within 10 miles of the project. They had been killed and left on the side of the road. Three Golden Eagles were observed in the area during this observation; one flew up from the carcasses with two Common Ravens (*Corvus corax*). The carcasses were collected and disposed of by a local wildlife rehabilitator (Cooney personal communication).

Because Central Oregon is an increasingly developed area, there are many factors that could potentially contribute to eagle mortality (Table 2).

Table 2:Potential eagle risk factors within 10 miles of the project.

Risk Category	Description
Collision with Motor Vehicles	Eagle collisions along Hwy 20 (birds foraging on Hwy 20, Crooked River Hwy, or Milican Road).
Electrocutions	Existing power lines (distribution and transmission) within 10 miles of the project area.
Renewable Energy	West Butte Wind project, future wind projects in the area.
Rangeland Management and Grazing Practice	Livestock grazing throughout area could draw eagles into the area to forage on carcasses (issues with ranchers or collisions with vehicles).
Habitat Loss and Fragmentation	OHV road use, future wind development, subdivision to north, alfalfa field—agriculture practices.
Lead Poisoning	Hunting on private and public lands in multiple use areas, coyote sport shooting
Recreation Activities (motorized)	Millican Plateau OHV Use Area (trail system)—disturbance caused by large-scale use of motorized vehicles
Wildfire and Suppression	BLM management (controlled burns), wildfires
Invasive Plant Species	Spotted knapweed, medusa-head, Cheat grass—effects on native habitat (impacts to sagebrush could affect jack-rabbit population (prey base).

Chapter 4: Environmental Consequences of the Alternatives including Cumulative Effects

4.1 Introduction

This chapter considers three alternatives that provide a reasonable range of options for responding to the WBWP application for a permit issued under 50 CFR 22.26, and evaluates the impacts of each alternative on the local area eagle population as well as the regional population. Alternatives considered include (1) No action, (2) issuance of a permit, and (3) issuance of a permit with additional conditions.

4.2 Take of Golden Eagles

A fundamental component of the Service's decision process for programmatic eagle take permits is evaluating the eagle mortality likely to occur due to the activity requested by the application. This eagle-mortality estimate assists the Service and applicant in developing a balanced ECP and permit application that includes sufficient avoidance and minimization measures, monitoring, adaptive management, and compensatory mitigation. The Service then uses the mortality estimate to determine if that level of take, with the offsetting measures proposed in the ECP, is compatible with the standards in the Bald and Golden Eagle Protection Act (50 CFR 22.26) and the NEPA analysis of those regulations (USFWS 2009a).

In its draft Guidance (USFWS 2011a), the Service provided a mathematical model that estimates fatality risk at wind project sites. The model relies on a logical assumption that there is a positive relationship between the number of minutes eagles are present in the air in close proximity to the turbines, the number of turbines, and risk of collisions by eagles. The results of the model predict the number of fatalities per year at the project site. The Service will continually refine this model as data from projects are used to test its accuracy. The latest iteration of the model (November 2011) was used to predict fatalities at the project.

The fatality prediction for the project using the Service's exposure-based model (in the Draft Guidance) yields a predicted mean of 0.39 eagles per year (sd = 0.62) with 80%, 90%, and 95% upper confidence limits of 0.56, 0.98, and 1.48 eagles per year, respectively. Thus, this model predicts that over 5 years up to 3 (using the 80 percent upper confidence limit) eagles will be killed incidentally to the operation of the project. (The Service typically will use the upper 80% confidence limit or similar measure of error around the estimated number of annual eagle fatalities for permit decisions in an effort to avoid underestimating fatality rates at wind projects (USFWS *in prep*).) The complete fatality prediction for the project is found in Appendix 3: West Butte Wind Power Project Golden Eagle Fatality Prediction.

Take includes disturbance as well as mortality (see Authorities, Section 1.4), and so we consider both in our analyses of the alternatives.

4.3 Alternative 1: No Action

Under the No Action alternative, we would deny the permit application and not issue a permit. We consider this alternative because we are required under NEPA to analyze a No Action alternative and, in this case, not issuing the permit is one of the potential responses to a permit application. We rejected consideration of a separate alternative of not even responding to the permit application (literally taking no action) because it is the expectation of the public, and therefore our obligation, to respond to all permit applications in a timely manner.

Under the No Action alternative, the Service denies the permit application either because the Service feels that the risk to eagles is essentially zero and that a permit to allow take is unnecessary, or because the application and conservation commitments made by the applicant in the accompanying ECP fail to meet any of several issuing criteria described under 50 CFR 22.26 (see Section 1.2 above).

Under this alternative, we assume that the applicant has completed all of the pre-project survey and inventory work that allow for an adequate assessment of eagle risk either by the Service or the applicant.

4.3.1 Effects

Direct Effects

The direct effects of the project becoming operational without an eagle take permit include the potential for take to occur at some level without any mitigating conservation action, which would be in violation of BGEPA and its implementing regulations. In the ECP, the applicant commits to conservation actions before any eagle mortalities occur. These conservation actions are designed to eliminate avoidable take of eagles and potentially achieve a conservation benefit to local and regional eagle populations. If the Service does not issue the permit, the applicant may not implement those actions and the Service would forego the opportunity to engage with the applicant in the development and implementation of such actions, and forego the chance to help achieve the Service's goal of stable or increasing breeding populations of eagles.

Because standardized post-construction monitoring would be unlikely in this scenario, incidental take might go unreported and the data might not be available to the Service; we emphasized in the Draft Guidance (USFWS 2011b) the key role monitoring plays in the adaptive management framework supporting our issuance of programmatic eagle take permits and in achieving the preservation standard.

Under the No Action alternative, it is difficult to quantify the direct impacts to the Golden Eagle populations at any scale, since the Service would not be provided with survey data and information necessary to quantify risk, properly conduct a fatality estimate, or recommend appropriate ACPs or compensatory mitigation. Furthermore, there would be no mechanism in place, such as a structured mortality monitoring program, to provide data to validate our eagle fatality estimate. We can assume that take occurring from the construction and operation of the project would at the least disturb eagles in the local area population and, at the most, have some level of impact on the population at the BCR scale; however, quantifying those impacts would not be possible.

If the project is not built because the Service chooses this alternative, then the direct effect would be no immediate change to eagle and migratory bird populations in the vicinity of West Butte.

<u>Indirect Effects</u>

If the project was built without a permit, and should lethal take occur (and be discovered incidentally since formal monitoring is unlikely in this scenario), the applicant would be considered in violation of BGEPA and might be subject to investigation by the Division of Law Enforcement. Clearly, if the Service decides not to issue a permit because we assess the risk to be zero, and take occurs, then the Service was in error and law enforcement action against the applicant would be unlikely. A more likely scenario is that the Service would approach the operator to encourage conservation actions that reduce take, and encourage the operator to apply again for a take permit. In the opposite scenario, in which the Service decides not to issue a permit because the application and conservation commitments made by the applicant fail to meet the Service's issuing criteria, then law enforcement action might be more likely.

If the project is built without an eagle take permit and no conservation measures are implemented, then other species of birds (e.g. other raptors) that might have benefited from those conservation actions would not realize that benefit. There were 55 species of landbirds protected by MBTA detected during wildlife surveys at West Butte, three species of upland gamebirds, including Greater Sage-Grouse, and two non-native species. Among the protected landbirds were 8 species of raptors [one is found during the winter only (Rough-legged Hawk)], and five species are considered Birds of Conservation Concern by the Service in BCRs 9 and 10 (FWS 2008). Three additional species of raptors and two additional Birds of Conservation Concern were encountered in transit to the West Butte site.

The mortality per MW of birds at 18 wind power projects in the arid west averaged 0.09/MW per year for raptors and 2.47/MW for all species (Table 5, Appendix A of the Wildlife Risk Assessment of the ABPP and ECP in Appendix 1). That is the equivalent of about 9 individual raptors and 260 individuals of all species taken per year for this 104 MW project if West Butte results in comparable take, but take here is expected to be lower. Raptor use at West Butte varied seasonally from 0.03, 0.145, and 0.23 birds per count period in winter, fall, and spring, respectively; these rates are among the lowest detected during pre-construction surveys at 11 other wind turbine sites in the west (0.25 to 3.5 birds/count), where there is also a correlation between raptor use and mortality rates (Erickson 2008). For passerines, pre-construction surveys yield a mean use at the WBWP site that varied from 1.78 to 10.7 birds per count (winter and fall respectively); these rates are also low relative to other sites in the northwest (Figure 1 in Appendix A of the ABPP and ECP, Appendix 1).

Townsend's solitaire (*Myadestes townsendi*), House finch (*Carpodacus mexicanus*), American robin (*Turdus migratorius*), and common raven (*Corvus corax*) accounted for 80% of all bird detections; solitaires accounted for over half of all detection, but they are winter visitors only.

On summer surveys, Brewer's Sparrow (*Spizella breweri*) and Mountain Bluebird (*Sialia currucoides*) accounted for over half of the birds detected. None of these species is commonly killed at other sites, but of these four species, likely only ravens are also commonly observed at other sites. Both American Robins and Mountain Bluebird were common at the Big Horn wind-power site in Washington, but both are rarely killed by the turbines there (Downes 2008). A species commonly killed at other sites in the west, Horned Lark (*Eremophila alpestris*) (Erickson 2008), was detected once only in the fall. Thus, the composition of species and low abundances suggest that if West Butte is built without a permit, it will result in bird mortalities, but fewer than other sites in the western United States relative to its size.

On the other hand, if the project is not built because the Service chooses this alternative, then these birds detected on West Butte and protected under MBTA, would not be at any risk of being taken.

<u>Cumulative Effects</u>

Negative cumulative effects to eagles might accrue if this project becomes operational without a permit for take. It is possible that a precedent is set where other potential developers might be more inclined to follow suit and bypass the permitting process altogether, potentially resulting in additional unreported take and further impacts to eagles. These projects would constitute lost opportunities to develop and implement ACPs, such as curtailments (temporary shutdown of turbines to mitigate issues), development of new avoidance and minimization technologies, habitat or nest site creation, and strategies for post-construction monitoring. While this might occur in a few cases, it is unlikely that it would be widespread. The Service would continue to help industry find solutions that minimize risk of eagle take at wind-power developments, and encourage permit applications that meet the Service's no-net-loss standard for breeding populations of eagles. In addition, many applicants likely would not be willing to risk the possibility of a law enforcement action if they proceed to build a project that results in the unauthorized take of eagles.

If in contrast, the project is not built because the Service chose this No Action alternative, then other projects might be inclined to also not follow through with their wind-energy development plans in this region. The effect on eagle populations and on other birds in this case would likely be positive in the immediate vicinity and perhaps across BCRs within the FWS Pacific Region. However, companies might then consider other regions in which to build wind projects, so there could be ramifications for Golden Eagles and other wildlife in other parts of their ranges.

Another cumulative effect is the possible impact of climate change on eagles and other migratory bird species in the region. Over the life of the project, the effects of climate change on the West Butte region will likely become more pronounced than they will globally. In the Pacific Northwest, annual average temperatures over the region as a whole rose about 1.5 degrees over the past century; the region's average temperature is projected to rise another 3 to 10 degrees in this century (U.S. Global Change Research Program, 2009). The primary driver of global temperature increases appears to be human-induced emissions of greenhouse gases (US Global Change Research Program 2009). Oregon's total greenhouse gas emissions in 2000 were approximately 68 million metric tons of carbon dioxide equivalents (Governor's Advisory Group on Global Warming 2004), with the largest source being carbon dioxide pollution from the burning of fossil fuels. While scientists lack sufficient information to understand or predict the responses to the kinds of long-term trends in climate change on wildlife, some changes in the timing of avian breeding and migration as well as a northward expansion of the geographic range in North American birds have already been documented (McCarty 2001; Peterson 2003; LaSorte and Thompson 2007). A summary of current research and climate models for eastern Washington predict not only warming trend, but generally drier summers, and wetter winters (WDFW 2011). Slight changes in these regimes can alter vegetation drastically over time. Increasing CO_2 may favor may also favor invasive grasses, exacerbating the current threat of cheatgrass (*Bromus tectorum*) in the intermountain west (Smith et al. 2000). The ultimate effect on Golden Eagles from these changes is difficult to predict, both in the vicinity of West Butte and more broadly. Whatever they are, these changes will likely have a larger overall effect on the population dynamics of Golden Eagles, and other species, in Oregon over the longer term than wind projects will; and this is true for any of the alternatives the Service might select. However, Golden Eagles as a species eat a variety of prey, range widely, and live across a broad regime of dry, wet, and cold climates in their North American range from Mexico to Alaska (Kockert et al. 2002), so while the population dynamics might change locally, the species might be resilient more broadly.

White and Kulcinski (1998) found that the construction, operation, and decommissioning of a wind-energy facility produces approximately 0.015 metric tons of carbon dioxide per megawatt-hour (MWh), with all of the operational contribution coming from maintenance activities and employee commutes. By way of comparison, the same measure for a coal-fired facility produces 0.974 metric tons of carbon dioxide per MWh (White and Kulcinski 1998). Therefore, a wind-energy facility produces about 1.5 percent of the carbon dioxide that a similar-sized coal facility produces. Wind energy is an important part of the global effort to reduce greenhouse gas emissions. While relatively small on a regional and national scale, projects like West Butte can cumulatively reduce greenhouse gas emissions by replacing coal-powered facilities. Detailed analysis of the climate change impacts arising from the construction and operation of the project itself, including greenhouse gas emissions, can be found in section 3.11.1 of the FEIS (pages 3-105 thru 3-108). Thus, the conservation benefit of these projects is in reducing the pace of ecological change from an altered climate. Were the project not to go forward because the Service selects the No Action alternative, this benefit would not be realized.

<u>Other Effects</u>

Direct, indirect and cumulative effects stemming from the construction and operation of the project on the human environment, including impacts to visual conditions, recreation, socioeconomic values, and cultural and religious values, were analyzed in detail in the EIS (BLM 2010a, pp. 3-76 to 3-105). The Service has initiated consultation with the sovereign nations of the Confederated Warm Springs Tribes, Klamath Tribe, and Burns Paiute Tribe, informing them of receipt of the eagle take application and preparation of this DEA. Consultation with these Tribal Governments will be ongoing throughout the permitting decision process. The Service has also completed Section 106 compliance with the National Historic Preservation Act and has received concurrence from the State Historic Preservation Office that our action of issuing a programmatic eagle take permit will not have significant impacts on the historical or cultural resources in the project area. The Service does not expect that failure to secure a programmatic eagle take permit will have significant direct, indirect, or cumulative effects to these aspects of the human environment.

4.4 Alternative 2: Issue Standard 5-year Permit

Under this alternative, the Service would be in receipt of an application and supportive information that is complete and consistent with 50 CFR 22.26. The Service would refer to the Guidance while reviewing the application and supportive information. The Service would issue a 5-year permit for take of up to 3 Golden Eagles (see Section 4.5.1 below) with compensatory mitigation required to produce a net take of zero, and the permit could be renewed after 5 years following review of project monitoring by the Service. Under this alternative, permit conditions would require the project to implement the conservation actions as identified in the ECP.

4.4.1 Consistency with Regulations at 50 CFR 22.26 and Draft Guidance

Under this alternative, the Service would assess whether the project application and supportive information are consistent with the standards and requirements of the 2009 Eagle Permit Rule at 50 CFR 22.26. In reaching this determination, we would use our Draft Guidance (USFWS 2011b) to evaluate the project's ECP in context of the 2009 Eagle Permit Rule. Our evaluation and rationale are explained below. We also provide a review of consistency with the 2009 Eagle Permit Rule requirements outlined in 50 CFR 22.26.

4.4.2 Consistency with Five Stages of Draft Guidance

The WBWP began pre-construction monitoring in 2007, and decisions about siting the project occurred earlier. It is considered an 'on ramp' project by the Service, in the sense that its planning, data collection, and timeline for development preceded the development of the Services' permitting regulation 50 CFR 22.26, and the Draft Guidance for implementing that permit. As such, the WBWP process for considering impacts to eagles does not exactly match the process recommended in the Draft Guidance, particularly stages one and two.

Stage 1 of the Draft Guidance suggests that developers look broadly across the landscape for areas of eagle use, consulting the Service (and others) as sources of biological information. Ultimate site selection for the project should balance suitability for development with potential risk to eagles. Despite West Butte's more advanced timing relative to the Draft Guidance, the project reviewed existing information, conducted database searches to ascertain the number of Golden Eagle territories in and near the project area, made contacts with agencies, and reviewed other wind projects during the initial stages of project development to assess project siting in relation to impacts to all wildlife. However, the Service is unaware of the ultimate reasons why the developer chose the West Butte site over some other site.

Stage 2 of the Draft Guidance addresses pre-construction monitoring effort. The project collected 3 years of survey data, including Golden Eagle territory identification and nest searches; 1 year of extensive on-site surveys for all species of birds in 2008; and 2 years of helicopter raptor nest surveys within 2 miles of the project footprint in 2008 and 2009. In 2010, the two Golden Eagle nests identified within 2 miles of the project boundary were monitored from the ground by a Golden Eagle specialist. The North nest tree was burned in a controlled burn in 2009, was not occupied in 2010, and is no longer useful for nesting. At the West nest, a breeding attempt was recorded but no eagles were fledged. A single Golden Eagle was detected in the project area during the year of avian-use surveys. On three other occasions, individual Golden Eagles were detected at distances outside the survey plots (and outside the area where project turbines are proposed), and Golden Eagles were detected on four occasions at lower elevations, well away from the project's proposed turbine locations. (See section 3.3 Biological Environment for a description of nests and surveys conducted by WBWP and others.)

The data collected by WBWP suggest low use of the project area by Golden Eagles. Possible explanations might be related to apparent low prey availability on the project site (as suggested by the observations of WBWP), lack of ridges or other topographic features that lead to ridge-soaring or kiting behavior, and low nest density in the project area. Golden Eagle prey species were not frequently encountered in the project area during bird surveys, although no standardized surveys for prey abundance or density were conducted. The project area does not contain rocky outcrops or irrigated fields that tend to concentrate mammal prey species or habitats that concentrate waterfowl. Four sage grouse leks, with long-term monitoring data, are located within the vicinity of West Butte. Lek counts show declines from an average of 62 males per lek in 1950 to 30 males per lek in 1960 to 11 males per lek in 1993 (Hanf et al. 1994). At the West Butte lek, the number of males dropped from 18 in 1988 to 3 in 1993 (Hanf et al. 1994). During pre-construction surveys for the West Butte Wind project, three and four males continued to occupy the lek in 2008 through 2010 (Gerhardt et al. 2008, 2010b). With these low numbers, sage grouse are unlikely to represent a significant prey item for Golden Eagles in the project area.

West Butte does not seem to function as a migratory corridor for raptors; its relatively gentle topography lacks the sharp relief that typifies sites of high raptor migration in other parts of the west; average raptor use during fall surveys was about mid-way between average use in the winter (lowest use) and spring (highest use) (Gerhardt 2010b). Additionally, the project area does not contain cliffs or rim rock for nesting. The project area does contain a small number of large ponderosa pines, and one of these (within approximately 2 miles of the project boundary) still contains an active Golden Eagle nest. The project monitored this nest from 2008 to 2010, and it was monitored again in 2011 independently, but no young eagles fledged during this period.

No eagle roosts were identified in the project area. Of the few Golden Eagle observations recorded during all aspects of studies for the project, none involved flight behaviors associated with territorial advertisement or defense. There are five recently-occupied Golden Eagle territories within 10 miles of the project area boundary; none fledged young in 2011, and beyond the West Butte West nest, all are 5 miles or further from the project area. (The mean inter-nest distance among these territories is 7.7 miles; see Figure A3-2 in Appendix 3.) Based on the location of these known Golden Eagle nests, the lack of Golden Eagle use of the project area, and the apparent lack of concentrations of eagle prey species in the project area, West Butte appears to be a little-used region between widely-separated Golden Eagle territories. Based on information developed in Stages 1, 2, and 3 of the project's ECP, the Service considers the project area a Category 2 location (high to moderate risk to eagles, with opportunity to mitigate impacts).

The project addressed Stage 3 by providing data on eagle use to the Service. The Stage 3 fatality prediction, using the Service's most recent exposure-based model, is 0.39 eagles per year (sd = .62) with an 80 percent upper confidence limit of 0.56 eagles per year; this equates to three eagles over 5 years (see Appendix 3: West Butte Wind Power Project Golden eagle Fatality Prediction). This fatality estimate is only based on turbine collisions and does not include any estimate of other mortality factors due to operation of the facility.

The project addressed Stage 4 by applying avoidance and minimization measures to further reduce anticipated take of Golden Eagles and, for the remaining unavoidable take, committed to compensatory mitigation actions consistent with those recommended in the Draft Guidance. Twenty-seven ACPs were proposed in the ECP which, in addition to compensatory measures, offset mortality predicted in the eagle-risk fatality model (Stage 3). These measures were discussed with the Service before the project finalized its ECP and reflect an adequate effort to avoid and minimize risk to eagles from the build out of the project to the maximum degree achievable. See Stage 5 discussion, below, for a discussion of the ACPs. The fatality estimate does not include consideration of ACPs that might moderate that risk, thus it is a conservative estimate of potential mortality at West Butte.

4.4.3 Compensatory Mitigation

The applicant has committed to implementing mitigation measures annually, regardless of eagle mortalities, and additional measures in response to each dead eagle found at the site and attributable to the operation of the wind farm. These measures are designed to offset eagle mortality and to assure that there will be no net loss of Golden Eagles caused by the project's operation.

The commitments by the applicant to offset Golden Eagle mortality include:

1. Working with the local utility to upgrade 11 “problem” power poles per year within 10 miles of the project area to bring the pole up to current APLIC standards regardless of eagle mortalities (‘upfront mitigation’).
2. For every Golden Eagle fatality resulting from the operation of the wind farm an additional 11 utility poles per year for the life of the project (on existing power lines) would be retrofitted to APLIC standards to prevent electrocutions.

In addition, the applicant has committed to the following conservation measures on behalf of Golden Eagle conservation.

1. Changing the cut-in speed from 3 meters/sec to 5 meters/sec for up to 1,464 hours per year, if monitoring can determine problem turbines and conditions under which mortalities are likely. (The cut-in speed is the wind speed at turbine height that triggers the turbines to begin spinning.) The change in cut-in speed would be implemented during daylight hours from April through November, when eagles are more likely to be present on the project site. It is predicted to reduce the operating time of the selected turbines from 90 percent to 60 percent (Appendix 1).
2. A one-time payment of $20,000 from WBWP to a third party would be used to address a high priority Golden Eagle conservation need, to be implemented in the year after any Golden Eagle mortality. This money might be used to retrofit more power poles, address issues of lead contamination in eagles, or to some other measure that results in reducing eagle mortality.
3. Implementation of new technologies that reduce the risk of eagle collisions if recommended measures become available.

4.4.4 Adaptive Management Measures for Migratory Birds and Bats

In the ABPP the applicant has also committed to implementing three progressive levels of ‘adaptive management’ (Table 3; see Appendix 1 for more detail). These will be implemented when mortalities of raptors other than eagles exceeds 0.11 fatalities per turbine per year(0.037–0.055/MW for 3- and 2-MW machines, respectively), or 2.48 fatalities of other birds per turbine per year (0.83–1.24 birds/MW again depending on machine size). The applicant commits to four years of post-construction monitoring to determine mortality rates at the developed site. During the first year, if mortalities exceed either threshold, level one adaptive management will be implemented; levels two and three are implemented if mortalities continue to exceed thresholds in two or three of the four monitoring years. Additionally, if mortalities exceed 10 birds per turbine, additional monitoring will be implemented to determine the cause of the mortalities, and a mitigation plan for that turbine will be created with the Service (see Post-Construction Monitoring, below).

Further, the applicant commits to a 6-month, statistically valid study of the efficacy of cut-in speeds in reducing avian mortalities, and to working with the Service on that study design.

Table 3:Three levels of adaptive management.

Level	Blade Painting	Monitoring	Other
1	Painting 25% of turbine blades, with efficacy study; designed with Service	1 year additional monitoring at ‘problem turbines;’ designed with Service	Retrofit 11 additional power poles each year baseline mortality is exceeded
2	25% more painted if study shows efficacy	1 more year monitoring at problem turbines	Conservation measures for passerines; could include juniper removal or other habitat enhancements
3	Balance of blades painted if shown to be effective	1 more year monitoring at problem turbines	Curtailment (cut-in speed from 3- to 5-m/sec) at likely turbines and times, from April through Nov, 10:00-16:00 hrs, not to exceed 1,464 hours total

4.4.5 Comparison of Predicted Golden Eagle Fatalities with Power Pole Retrofits as Compensatory Mitigation

The essential analysis for the issuance of the programmatic take permit is a comparison of the predicted eagle fatalities (Section 4.2 and Appendix 3) with the level of compensatory mitigation proposed by the applicant. WBWP has committed to retrofitting a constant rate of 11 poles per year regardless of the number of eagle fatalities due to the operation of this wind power site (see Table 4). Using a 11:1 (poles:eagles) rate, this upfront conservation commitment will essentially offset five eagle fatalities over 5 years. The derivation of this ratio stems from the resource equivalency analysis in the Draft Guidance (2011b). The analysis in that document estimated a pole:eagle ratio of 5:1, given certain assumptions about rates of mortality at distribution lines in western states, lost reproduction by turbine blade victims, survival rates of various age classes of eagles, years of service expected with any given retrofit, and other parameters. The applicant was willing to essentially double that rate and commit to fixing 5 poles on either side of problem poles, in addition to the problem pole itself.

WBWP is willing to fix 55 poles in five years regardless of eagle mortalities; this is the equivalent of 5 saved eagles using the 11:1 ratio. Compared to the mean fatality estimate of two eagles over 5 years (Section 4.2), the upfront mitigation alone is sufficient to offset the predicted eagle fatalities by 2½ times; it is also sufficient to offset 0.56 fatalities per year, the predicted fatalities at the 80 percent upper confidence limit. (It is insufficient to offset the eight predicted fatalities over 5 years at the 95% upper confidence limit.) If no or few eagles are killed, the baseline level of conservation commitment has the potential to build “eagle credit”, that is, a net benefit to eagles. In addition to baseline pole retrofits, the applicant has committed to retrofitting an additional 11 poles for the life of the project for every eagle fatality. Table 4 shows the potential result in terms of eagle offsets over 5 and 10 years at the mean estimated fatality risk, 2 eagles over 5 years (0.39 eagles per year).

Table 4: Power Pole Retrofits, Eagle Offset[1], and Poles per Fatality[2].

Year	Baseline	Eagle Fatalities[3] 1	2	3	4	Total	Eagle Offset	Poles per Fatality
1	11							
2	11							
3	11	11						
4	11	11						
5	11	11	11			**99**	**9**	**50**
6	11	11	11					
7	11	11	11					
8	11	11	11	11				
9	11	11	11	11				
10	11	11	11	11	11			
Total	**110**	**88**	**66**	**33**	**11**	**308**	**28**	**77**

1 – Eagle Offset is the estimated number of eagles saved by power pole retrofits, using, in this case, a ratio of 11 poles retrofitted to 1 eagle saved.
2 – Poles per Fatality is the number of poles retrofitted to offset expected mortality after given time periods, rounded up.
3 – Mean predicted fatalities, in years 3 and 5 of every 5-yr increment.

The result of this simplistic analysis shows that WBWP will offset the mortality of two eagles by saving nine via retrofits (a potential credit of 7 eagles). The scale of Eagle Offsets continues to rise disproportionately to predicted fatalities over 30 years such that at the end of 30 years, 2,244 poles will be retrofitted, equating to 204 eagles using an 11:1 ratio, offsetting the predicted fatality of 12 eagles (a potential credit of 190 eagles). Table 5 shows the results of the same analysis but using a fatality rate of 1.48 per year (that is the predicted annual mortality rate at the 95% UCL). The Eagle Offset grows disproportionately to the predicted fatalities assuming the 11:1 ratio.

Another way to examine the conservation commitment is to compare the total number of poles retrofitted relative to expected fatalities (Poles per Fatality). If fatalities met the estimate of 1.48 eagles per year, then about 19 poles would be retrofitted for every eagle fatality (Table 5). The Poles per Fatality value also continues to rise over time (as with the Eagle Offset), such that after 30 years of this level of mortality 42 poles will be retrofitted for every eagle fatality (Table 5). The calculation of Poles per Fatality allows for an evaluation of the conservation commitment at West Butte with other sites, or with other valuations of eagles that might result in alternative ratios of pole retrofits necessary to offset fatalities (e.g. other than 11:1).

Table 5: Metrics of Pole Retrofits over 30 years1.

Year	Predicted Fatality	# Retrofit	Eagle Offset	Poles per Fatality
5	7	132	12	19
10	15	304	28	20
15	22	561	51	26
20	30	904	82	30
25	37	1333	121	36
30	44	1848	168	42

1 – Assumes annual fatality = 1.48 eagles (at 95% UCL). Numbers are rounded.

In these calculations we assume that retrofitted power poles remain raptor safe for the life of the project, yet we know that some retrofitting solutions require periodic maintenance to remain effective. If we assume that retrofits in this example have an effective life of 10 years rather than 30 (the predicted life span of WBWP), then the conservation benefit is somewhat less; regardless, the number of poles effectively retrofitted at any point in time offsets the cumulative predicted fatalities.

This analysis shows that the mitigation proposed by the applicant should result in a net conservation benefit to the eagles in the project area. It is based on generalizations about the value of retrofitting power poles to eagles in the Draft Guidance, and ultimately relies on electrocution rates in other western states. Ideally, these values would be locally-derived, however at this time we have no specific data on electrocutions in the vicinity of the project.

4.4.6 Effects of Additional Mitigation Measures

Changing the cut-in speed of turbines, a monetary contribution, and the willingness to use new technologies that might reduce eagle mortality add to the compensatory mitigation package, but in a less directly measurable way than power pole retrofits; for example, increasing the cut-in speed of turbines, even though it has the effect of reducing the hours that turbines are spinning, has not been shown to be an effective means of reducing eagle mortality. Nonetheless, these additional conservation commitments may increase the net conservation benefit to eagles from this project by some measure.

The implementation of these measures might reduce eagle risk, and in theory, could change the calculation of fatality risk. The risk model does not incorporate these considerations now, but might be components of a fatality risk model in the future.

4.4.7 Post-Construction Monitoring

The project addressed Stage 5 by proposing a post-construction survey program for the life of the project. The objective of a post-construction monitoring program is to estimate the annual number of eagle fatalities at the project and the circumstances under which they occurred. Post-construction monitoring includes:

1. Post-construction fatality searches during a two-year study period, in the first year of operation and in year five of operation. Thirteen turbines (1/3 of the 40 turbines) will be searched systematically once each month during winter and summer and twice each month during spring and fall, in the first year. Thirteen different turbines will be searched the second year.
2. Training for maintenance personnel to survey the area surrounding turbines during routine maintenance for the life of the project. Any Golden Eagle fatality or injury will be reported within 24 hours to the Service's Office of Law Enforcement, Portland Regional Office, and Bend Field Office**.**
3. Additional monitoring of any turbine or cluster of turbines that cause a Golden Eagle fatality will be initiated immediately after such a fatality occurs (two visits per month for 6 months after the fatality).
4. Aerial surveys of eagle territory occupancy and productivity within six miles of the project will be conducted in year one and five, and every five years following construction.
5. Ground-based surveys for productivity of eagle nests (those on or viewable from public lands) within six miles of the site every year for the first five years of operation, and for an additional year after a Golden Eagle fatality at the project site.
6. A commitment to use telemetry to track one adult from each territory within six miles of the project site, and one juvenile produced by any nest within six miles. If the capture attempts are unsuccessful after three years of trying, then WBWP commits to monthly monitoring of the territories for eagle territory use, for three years. [The Service will discourage telemetry, at least for adults on territory, as there is some question about the effect these tracking units have on their survival (USFWS *in prep*). Instead, the Service will encourage the ground-based three-year study of territory use from observation points.]
7. If 10 avian fatalities occur per turbine or cluster of turbines, WBWP will work with the Service to develop a Monitoring and Mitigation Plan for the turbine(s) in question.

4.4.8 Effects of the Action

Direct Effects

The primary direct effect of this alternative is that a permit is issued for the legal take of up to three Golden Eagles over 5 years. We assume the project is built, all ACPs and compensatory mitigation requirements fulfilled, and that some eagles die at this site from the operation of the turbines. The magnitude of the effect on the local eagle population in this case depends on the age, origin, and status of the birds killed. Although this is not a migratory corridor for eagles or raptors in general, it is possible that a migrant eagle would pass through and be struck by a turbine. In that case, the mortality would not directly affect the dynamics of the local population; however, it might affect the breeding population to which it belongs.

The loss of any immature bird is the loss of a potential future breeding adult, and contributor to the local breeding population. Golden Eagles do not begin nesting until their fourth, fifth, or later years; studies suggest that half or fewer of the birds that survive to independence survive to breeding age (citations in Kochert et al. 2002). If the bird were a young of the year and from a local nest, or from elsewhere in either BCR 9 or 10, there might be a small effect on the dynamics of the local population through reduced competition with other eagles, for example. Non-nesting adults, floaters, could have larger consequences for the population. Floaters function as replacement breeders for territory-holding birds that die for whatever reason. If the local floater population is robust, they quickly fill territories that have lost a breeding adult, and function to maintain stable Golden Eagle populations through time. Studies have shown that the time it takes floaters to fill a vacant breeding position varied from days to weeks (Kochert et al. 2002). The size of the floater population is difficult to measure, but the buffering effect of floaters on breeding population size is considered a critical feature of healthy, stable populations of raptors in general (Hunt 1998).

The most significant direct effect upon the eagle population would be the loss of a territory-holding adult. These birds are replaced by floaters if there is a robust population of non-breeding adults in the area. However the continual loss of adults from a single territory, and their replacement by floaters, becomes an unnatural drain on the floater population.

The converse applies to the effects of the compensatory mitigation. That is, the birds saved from electrocution from the pole retrofits have the same degree of effect on the local population, but in a beneficial rather than negative way. The comparison (above) of the magnitudes of the predicted fatalities and the compensatory mitigation to offset them suggests that the local area population of Golden Eagles could receive a net conservation benefit from these mitigations.

Although it is the expectation that those mitigations will save eagles from electrocutions, it is difficult to predict whether or not the birds saved will be local, or (in the fall, winter, or spring) be migrants from other areas. It is possible that local populations of young birds and floaters will increase as a result of the power pole retrofits, potentially leading to increased eagle use (and potential collisions) on West Butte. The site assessment suggests however that eagle use is low because of prey availability and topographic features, neither of which is predicted to change. Ultimately, post-construction monitoring will assess the degree of eagle mortality at the site, whether it increases or decreases over time, and which in turn determines the numbers of poles to be retrofitted annually. Post-construction monitoring of territory occupancy and productivity of Golden Eagles nesting within six miles of the project will be a measure, although imperfect, of the long-term effect of this project on locally-breeding eagles.

It is possible that, as a result of the compensatory mitigation, there could be an increase in the density of eagles locally. This might be the case, for instance, if the rate of electrocutions was so high that certain eagle territories have remained unfilled locally.

The discussion of effects from this action has so far centered on direct mortality. Disturbance (see definition under Section 1.4 Authorities) is also a possible issue with the development of WBWP. The development itself is nearly 2 miles from the West nest, the nearest Golden Eagle nest to the project. Nests beyond one mile from activities are generally considered safe from effects of disturbance, particularly those outside of line-of-sight with respect to those activities. It is possible that eagles could attempt to rebuild a nest near the North nest, formerly a quarter mile from the project footprint before it burned in a controlled fire in 2009. In that case activities associated with daily operations at the wind turbines might disturb a nesting pair. It is also possible that construction activities might disturb the eagles if they chose to rebuild their nest or were actively nesting during that time. WBWP has committed to monitor raptor nests during construction and working with project contractors to minimize disturbance by construction activities (Appendix 1, Section 6.0).

<u>Indirect Effects</u>

The analysis of effects on other species of birds is to some extent covered in the ABPP and ECP submitted by the applicant (Appendix 1). A permitted project at West Butte is expected to take some birds other than eagles that are protected under the MBTA, as discussed above under the No Action alternative (Indirect Effects). However, ACPs (e.g. cut-in speed adjustments) and compensatory mitigation that the applicant undertakes on behalf of eagles might also lower the mortality rate of these other protected species. The compensatory mitigation will likely could benefit other raptors, by reducing the opportunity for electrocutions from non-APLIC compliant power poles. Impacts to raptors from electrocutions are generally considered to be more ecologically significant than the impact on smaller species, as raptors have smaller populations and generally slower population-growth rates. If raptor populations improve as a result of these efforts, there might be cascading effects down the food chain, but the specific effects are difficult to predict.

However, the applicant specifically identifies conservation measures for other species, which will be implemented in 3 stages dependent on levels of mortality revealed by post-construction monitoring and independent of eagle mortalities (see Adaptive Management Measures for Birds and Bats in Section 4.5, above). These include power-pole retrofits. Although these commitments to conservation would not be conditions on an eagle take permit, the applicant might be more likely to implement these commitments were the project permitted. The measures are only triggered, however, if the project exceeds annual mortality thresholds. The mortality thresholds chosen as triggers (for raptors, 0.037–0.055/MW for 3- and 2-MW machines, and for other birds, 0.83–1.24 birds/MW) are lower than the average annual mortality seen at 18 other western sites (0.09/MW for raptors and 2.47/MW for other species; Table 5, Appendix A of the Wildlife Risk Assessment of the ABPP and ECP in Appendix 1).

An indirect effect of this alternative is internal to the Service's permitting process. By selecting this alternative, we are potentially establishing a baseline for issuance of programmatic eagle take permits. Mortality monitoring will help the Service evaluate the effectiveness of the fatality-risk modeling and the conservation measures the applicant has committed to. The permitting process for this project will help the Service develop effective ECPs with other future applicants.

Cumulative Effects

By issuing a permit, the Service predicts that any take of eagles will be offset through conservation commitments made by the applicant. The applicant has committed to mitigations that may potentially exceed expected eagle fatalities at this development, perhaps by several times (see analysis above). One potential outcome of this action is that other wind-power projects, near West Butte or not, might adopt similar avoidance and minimization measures, ACPs, and compensatory mitigation measures in proportion to the predicted eagle-fatality risk at those proposed development sites. The net effect could be additional conservation benefits to eagles and other migratory birds. The benefits from power pole retrofits could potentially continue until most power poles in the range of Golden Eagles are fixed. The cumulative effect might offset not only mortality from well-sited wind power projects, but from other sources of mortality as well.

Balancing this effect, in any given area where there are breeding eagles and potential wind projects, it is possible that the density of other projects (or turbines from a single project) are sited so poorly relative to some breeding pairs that mortalities overwhelm their productivity and reduce replacement birds to the level that territories are lost. If this were repeated across the landscape, over time the cohort of replacement breeders, floaters, is reduced and population decline becomes inevitable. This scenario seems unlikely, however, as the Service is committed to helping industry find solutions that minimize risk of eagle take at wind-power developments, and would continue to encourage permit applications that meet the Service's no-net-loss standard for breeding populations of eagles.

There will likely be other types of developments in the vicinity of West Butte in the future that might detrimentally affect eagle populations, for example, rural development resulting in habitat fragmentation and disturbance to territory-holding eagles; construction of additional distribution or transmission lines, roadways, and other infrastructure; or other effects of an expanding human footprint. The population of Bend, Oregon, 25 miles west of West Butte, grew by 150 percent between 1990 and 2000, and another 47 percent between 2000 and 2010 censuses; it is central Oregon's largest city, and with outlying towns, has a combined population of roughly 158,000 (PSU 2011). Prineville, Oregon, 25 miles north of the site, has a population of fewer than 10,000, but also grew by about 30% between 2000 and 2010. If the human population in this area continues to expand as it has in the last 20 years, then over the life of this project there could be additional pressure on eagles in this region, particularly from recreational disturbance, habitat degradation which might affect foraging potential, and loss of potential nesting areas.

The climate change scenarios discussed under the No Action alternative hold here as well. Under this alternative, however, the project is more likely to be built, and thus any benefit that this and other wind projects (and other renewable energy projects) have on reducing the pace of climate change might affect eagles. As stated previously however, Golden Eagles might adjust well to the ecological changes brought about by climate change.

<u>Other Effects</u>

As described under the No Action alternative, the effects on aspects of the human environment other than eagle populations from the West Butte development were analyzed in detail in the West Butte Final Environment Impact Statement (BLM 2010b). We reiterate here that the Service has initiated consultation with the sovereign nations in the vicinity of the West Butte project, informing them of receipt of the permit application and about the preparation of this DEA. Consultation with these tribal governments will be ongoing throughout this analysis and permitting process. The Service has also completed Section 106 compliance with the National Historic Preservation Act and has received concurrence from the State Historic Preservation Office that our action of issuing a programmatic eagle take permit will not have significant impacts to the historic or cultural resources in the project area. The Service does not expect that issuing this programmatic eagle take permit will have significant direct, indirect, or cumulative effects to these aspects of the human environment.

4.5 Alternative 3: Issue 5-year Permit with Additional Conditions

Under this alternative, the Service would require monitoring, research, and mitigation measures that would be added as conditions to the programmatic eagle take permit we issue under 50 CFR 22.26. These would be implementable additions, and could include more extensive commitments to monitor, implement more curtailments, fund additional research, implement new technologies that reduce mortalities as they become available, and engage in habitat improvements. The Service's permit regulations authorize the Director to incorporate any conditions deemed appropriate, in addition to those already required by other regulatory provisions (50 CFR 13.21(e)(1)).

Commitments to monitor could include annual monitoring by an onsite environmental monitor, or by a third party, of every turbine at West Butte. Research could focus on identifying factors that increase or decrease the likelihood of eagle collisions, either at West Butte or at sites with higher eagle use.

One research alternative could focus on the influence of lead contamination in Golden Eagles in the vicinity of West Butte. The toxic and sub-chronic negative effects of ingested lead shot or bullet fragments on eagles have been well-documented locally and worldwide (Stauber et al. 2010; Pain et al. 2009; AP 2007), and bans on use of lead for hunting effectively reduces contamination in scavengers such as Golden Eagles (Kelly et al. 2011). Previous research on lead contamination in Golden Eagles in the northwest has already shown that it spikes in the fall and winter, correlated with deer and elk seasons, and later with coyote hunting practices (Stauber et al. 2010).

The addition of remote monitoring technology that automatically trigger turbine shut-downs when birds approach; or impose curtailment (turbine shut-downs) at turbines where mortalities occur. These conditions of permit issuance would be in addition to the conservation commitments the applicant has already made.

WBWP could engage with partners in extensive habitat improvements, or nest-site enhancements. There is considerable investment currently in improving habitat conditions for Greater Sage-Grouse through the combined efforts of USDA in partnership with states, the Intermountain West Joint Venture, private partners, and non-governmental organizations (USDA 2011, IWJV 2011). Private sources of funding are highly desirable to leverage money for Federal conservation projects, many of which require non-Federal matching funds. WBWP could seek opportunities to improve riparian habitats in the vicinity of this project. Both of these types of projects would be aimed at improving food resources for Golden Eagles, as improved shrub-steppe habitat could improve conditions for jack-rabbits, cottontails, and other mammals that eagles prey upon, in addition to Sage-Grouse. Healthy riparian habitats also provide resources for prey and might improve hunting prospects for Golden Eagles.

Some Golden Eagle nest sites might suffer from disturbance by people either recreating in the vicinity of the nest or even by researchers, which causes them to fail (Kochert et al. 2002). As a first step, WBWP could engage with partners to limit human-caused disturbances at nest sites with documented disturbance issues at nests nearest the project first, but generally at nest sites within the population area of the WBWP.

Golden Eagles nest mostly on cliffs and in tall trees; however, they also use a wide variety of artificial structures on which to nest (Kochert et al. 2002). Artificial nesting platforms could be erected where territorial pairs have lost a nest site. This should only be undertaken with the advice of the Service and State wildlife agencies, and should only be sited several miles from wind developments.

4.5.1 Effects

Direct Effects

Additional conditions on the permit would result in an even greater conservation benefit to eagles than under Alternative 2. More thorough post-construction monitoring would lead to a more complete and unbiased estimate of eagle mortality at the site than proposed. These data would help in the application of advanced conservation practices, such as curtailment options, and better inform the degree to which the applicant should engage in compensatory mitigation.

Research on lead and eagles in the vicinity of West Butte, or more broadly, might result in positive actions that reduce levels of this toxin in the environment, through hunter education programs, or even working with others to develop new regulations that restrict the use of lead bullets and shot. Birds with high but sub-lethal doses of lead lose muscle control, are uncoordinated in their movements, and fail to feed or fly properly. These birds are very likely much more vulnerable to collisions with wind turbines, vehicle collisions, collisions with wires or fences, and to depredation by other predators. Eagles compromised by lead are regularly brought to wildlife rehabilitation centers in the northwest for treatment, often found emaciated, moribund, or as collision victims (AP 2009). They very likely represent only a fraction of those negatively affected by lead (Stauber et al. 2010). A study to examine the benefits of a lead ban locally could entail a detailed look at lead levels in the blood of breeding birds before and after a ban, and perhaps include measures of survival and productivity, both of which might rise with a broad-scale ban on lead.

Investments by the applicant in remote technology could directly benefit eagles. Systems are being tested currently at facilities in the United States and in Europe that tie radar detections of birds approaching turbines to the operation of the turbines themselves (Erickson 2011); turbines are shut down as the birds approach. As these systems are refined and become more effective they could be employed at West Butte. This type of technology could potentially prevent eagle collisions entirely.

Or the developer could employ seasonal or area-specific shutdowns of turbines if monitoring data showed patterns in eagle mortalities. The risk of eagle fatalities would be less as a result.

If the developer were to engage with partners to limit disturbance at eagle nests at sites with a documented history of failure due to human-caused disturbance, then there would certainly be benefits to the productivity of those nesting pairs. To some extent, if there were disturbance effects from the building or operation of WBWP on the North or West nests, then the additional conservation activities might offset that disturbance.

Indirect Effects

The additional permit conditions could have ramifications beyond West Butte. In this sense, they would be broader indirect effects of the project's actions taken to improve conditions of eagles locally. More extensive post-construction monitoring would help the Service refine fatality modeling not only at the WBWP, but the data could be used in conjunction with data from many sites to improve the predictive capabilities of the eagle-fatality risk model; better data will yield a more accurate predictive model.

Other species of birds would benefit from additional habitat projects. Bird species dependent on shrub-steppe habitats, several of which are Birds of Conservation Concern (USFWS 2008), might show population increases as a result of this alternative. Dozens of riparian-dependent birds would also benefit from riparian conservation projects. Riparian habitats in the arid west provide breeding habitat for dozens of species (Krueper et al. 2003, Heltzel and Earnst 2006), as well as stop-over habitat for thousands of individual birds, particularly in the spring (Carlisle et al. 2009).

Artificial nest sites erected for eagles might be used by other raptors. They have been used effectively for Ferruginous Hawks (Neal et al.), a Bird of Conservation Concern (USFWS 2008).

Cumulative Effects

A potential effect of implementing these conditions on the permit would be that other companies might consider them untenable and decide not to develop as a result. This would likely be a net benefit to eagles as there would be less of a fatality risk from wind-power projects.

Efforts to abate lead in the vicinity of West Butte and monitoring the efficacy of those efforts could lead to similar efforts in other areas and an expanding ripple effect of conservation actions. If research and monitoring the effects of a local lead ban showed benefits to eagles, then this might result in a more widespread condemnation of the use of lead ammunition, and to a widespread ban on its use.

Similarly, the use of an effective, real-time radar unit that shut down spinning blades when large birds approach could be encouraged at other projects. If this technology were adopted by other projects as result, with equally good results, then there would be a benefit to the local eagle population, and potentially to eagle populations in other areas. And, effectively-employed turbine shut-downs might lead other companies to employ similar shut-downs on their own projects.

Other Effects

As described under both preceding alternatives, the effects on aspects of the human environment other than on eagle populations from the West Butte development were analyzed in detail in the West Butte Final Environment Impact Statement (BLM 2010b). We reiterate here, that the Service has initiated consultation with the sovereign nations in the vicinity of the West Butte project, informing them of receipt of the permit application and about the preparation of this DEA. Consultation with these tribal governments will be ongoing throughout this analysis and permitting process. The Service has also completed Section 106 compliance with the National Historic Preservation Act and has received concurrence from the State Historic Preservation Office that our action of issuing a programmatic eagle take permit will not have significant impacts to the historical or cultural resources in the project area. The Service does not expect that issuing this programmatic eagle take permit with additional conditions will have significant direct, indirect, or cumulative effects to these aspects of the human environment.

Chapter 5: Results

5.1 Conclusion

Before the Service may issue a programmatic eagle take permit under 50 CFR 22.26, we must determine that: (1) the direct, indirect effects of the take and required mitigation, with the cumulative effects of other permitted take, are compatible with the preservation of bald eagles and golden eagles; (2) the taking is associated with, but not the purpose of, the activity; (3) the take is unavoidable and will occur despite application of advanced conservation practices; and (4) any unavoidable take in excess of regional take thresholds is balanced by an equivalent reduction in take achieved by compensatory mitigation. In our review of the WBWP application for programmatic take of Golden Eagles, we determined that the application appears to be consistent with these issuing criteria.

In our analysis we considered four alternatives to issuing a permit, including Alternative One, the No Action alternative of not issuing a permit. Under Alternative Two, the Service would issue the permit essentially as it was applied for so long as the application complies with the requirements of the Eagle Act and 50 CFR 22.26, without requiring additional conditions, ACPs, mitigations, or other commitments to conservation that the applicant did not itself propose. Alternative Three would require additional conservation commitments from the developer. A fourth alternative, issue a 30-year permit, was discarded because the Service is not yet able to issue permits for more than 5 years.

In our evaluation of the risk of the project to eagles, we considered the available information on number and status of Golden Eagle territories within 10 miles of the project footprint, and on numbers of eagles statewide and population trends within BCRs 9 and 10. We evaluated the eagle-use data collected by the developer during pre-construction surveys and predicted annual eagle fatalities based on those data. This number constitutes a conservative (over-) estimate of risk, but provides the Service and the developer with a precautionary approach to regulatory compliance. The fatality estimate was evaluated against the commitment of the developer to offset mortalities through mitigation.

We have determined that both Alternatives two and three will likely meet our permitting criteria and potentially deliver a conservation benefit to Golden Eagles, and would support our purpose and need described in Section 1.2. Alternative two adequately meets our purpose and need, was proposed by the applicant, and thus is our preferred alternative.

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Appendix 1: West Butte Wind Power Project Final Avian and Bat Protection Plan and Golden Eagle Conservation Plan

This file is 6 MB, and available for download at *http://www.fws.gov/pacific/migratorybirds/nepa.html*.

Appendix 2: List of Authorities

Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.) (BGEPA)
The Eagle Act provides that the Secretary of the Interior may authorize certain, otherwise-prohibited activities through promulgation of regulations. The Secretary is authorized to prescribe regulations permitting the “taking, possession, and transportation of [bald or golden eagles] for the scientific or exhibition purposes of public museums, scientific societies, and zoological parks, or for the religious purposes of Indian tribes, or . . . for the protection of wildlife or of agricultural or other interests in any particular locality,” provided such permits are “compatible with the preservation of the bald eagle or the golden eagle” (16 U.S.C. 668a). In accordance with this authority, the Secretary has promulgated Eagle Act permit regulations for the following activities: scientific and exhibition purposes (50 CFR 22.21); Indian religious purposes (50 CFR 22.22); take of depredating eagles (50 CFR 22.23); possession of golden eagles for falconry (50 CFR 22.24); take of golden eagle nests that interfere with resource development or recovery operations (50 CFR 22.25); non-purposeful take of eagles “for the protection of . . . other interests in any particular locality” (50 CFR 22.26); and removal of bald and golden eagle nests in certain situations (50 CFR 22.27).

National Environmental Policy Act of 1969, as amended (NEPA) (42 U.S.C. 4321 et seq.)
Agencies must complete environmental documents pursuant to NEPA before implementing Federal actions. NEPA requires careful evaluation of the need for action, and that Federal actions are considered alongside all reasonable alternatives, including the “No Action Alternative.” NEPA also requires the action agency to consider the potential impacts on the human environment of each alternative. The decision maker(s) must consider the alternatives and impacts prior to implementation, and must inform the public of these deliberations. The Service has prepared this FEA in compliance with NEPA; the President’s Council for Environmental Quality (CEQ) Regulations, (40 CFR 1500–1508); and the NEPA-compliance requirements in the Department of the Interior’s Departmental Manual (DM) and the Fish and Wildlife Service’s Manual (FW) (516 DM 8, 550 FW 1-3, 505 FW 1-5).

Migratory Bird Treaty Act, as amended (MBTA) (16 U.S.C. 703 et seq.)
The MBTA provides the Service with the regulatory authority to protect species of birds that migrate outside the United States. For eagle take, a separate authorization under the MBTA is not required. Many impacts authorized under the ESA that will require Eagle Act authorization will not “take” eagles under the MBTA because that statute does not contain a prohibition against disturbance (without injury) of the birds it protects. Therefore, activities that disturb an eagle will not require MBTA authorization unless the activity also results in injury or some other impact prohibited by the MBTA. Even where MBTA take will occur, a separate MBTA authorization in addition to the Eagle Act authorization is not required because 50 CFR 22.11(a) exempts those who hold Eagle Act permits from the requirement to obtain an MBTA permit.

National Historic Preservation Act of 1966, as amended (NHPA) (16 U.S.C 470 et seq.)
Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties. Federal agencies accomplish this by following the Section 106 regulations, "Protection of Historic Properties" (36 CFR Part 800). The Section 106 regulations set forth a process by which agencies: 1) evaluate the effects of any Federal undertaking on historic properties (properties included in, or eligible for inclusion in, the National Register of Historic Places (National Register)); 2) consult with State Historic Preservation Officers (SHPO), Tribal Historic Preservation Officers (THPOs), and other appropriate consulting parties regarding the identification and evaluation of historic properties, assessment of effects on historic properties, and the resolution of adverse effects; and 3) consult with appropriate American Indian Tribes (Tribes) and Native Hawaiian Organizations (NHOs) to determine whether they have concerns about historic properties of religious and cultural significance in areas of these Federal undertakings.
Some Tribes and tribal members may consider eagle nests sacred sites provided for in the American Indian Religious Freedom Act (42 U.S.C. 1996) (some are frequently referred to as Traditional Cultural Properties (TCPs)), and as potential historic properties of religious and cultural importance under the NHPA. Such sites are not limited to currently-recognized Indian lands, and they occur across the entire aboriginal settlement area. In addition, some tribes may consider all eagles and eagle nests as TCPs or sacred sites, and potential historic properties of religious and cultural significance which must be considered under Section 106 of NHPA. Properties of religious and cultural importance may be areas where eagles nest and have nested within living memory, their presence becoming a contributing element for determining eligibility under NHPA (King 2006, Tanji 2008)). Thus, a landform or landscape known for eagle habitation—a ridgeline, canyon, lakeshore, river valley, mesa, mountain, etc. — may be considered by Tribes as suitable for designation as a property of religious or cultural importance. Federal agencies having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking shall take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register.

Executive Order 13175, Consultation and Coordination with Tribal Governments (65 FR 67249, Nov. 9, 2000)
This Executive Order emphasizes the need for regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, the responsibility to strengthen the United States government-to-government relationships with Indian tribes, and the responsibility to reduce the imposition of unfunded mandates upon Indian tribes. Each Service Regional Director, in coordination with the Service Regional NAL, conducts government-to-government consultation with the tribes in their Region, and will do so on permits under this proposal. In order to ensure consistent, appropriate consultation, the implementation guidance for this proposal, which will also be available for public comment, will contain guidelines on government to- government consultation. To facilitate coordination of our multiple responsibilities, our Tribal consultations will advise the Tribes that we are providing them notice under all applicable federal mandates, and we will list them: the American Indian Religious Freedom Act (42 USC 1996), the Religious

Freedom Restoration Act (42 USC 2000bb et seq.), BGEPA, E.O. 13007 (if applicable), E.O. 13175, and NHPA. We will also indicate that our notice and invitation to consult is being provided in an effort to carry out our trust responsibility to Tribes, with regard to the unique, traditional religious and cultural significance of eagles to Native American communities, and in furtherance of the reserved rights of Native communities with respect to eagles.

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (66 FR 3853, Jan. 17, 2001)

This Executive Order specifies the need to avoid or minimize adverse impacts on migratory bird resources when conducting agency actions, as well as the need to restore and enhance the habitat of migratory birds. The proposal, through its standards for incorporation of avoidance and minimization measures, is consistent with the goals of this Executive Order. The local Ecological Services and Regional Offices will review any mitigation proposals to ensure they do not adversely affect populations of other migratory bird species.

Appendix 3: West Butte Wind Power Project Golden Eagle Fatality Prediction and Inter-nest Distance Calculation

A3-1 Fatality Prediction

Background

A fundamental component of the Service's decision process for programmatic eagle take permits is evaluating the amount of eagle mortality that is likely to occur in association with the activity addressed by the permit. The FWS must then determine if that level of take is compatible with the standards in the Bald and Golden Eagle Protection Act, as embodied in the regulations at 50 CFR 22.26 and the National Environmental Policy Act analysis of those regulations (USFWS 2009).

The FWS uses an exposure-based model with site-specific estimates of eagle use of the project footprint for such assessments, as outlined in the Eagle Conservation Plan Draft Guidance (ECPG; USFWS 2011). The FWS's exposure-based model is predicated on the assumption that there is a positive relationship between the number of minutes eagles are present in the air over a wind project footprint, the number of turbines present and the associated "hazardous" airspace, and the number of fatalities that will occur. This assumption, and others inherent in the model, will be evaluated using post-construction fatality data collected at permitted wind project sites (USFWS 2011). The FWS acknowledges the uncertainty in the eagle fatality predictions, and considers upper credible limits of the fatality estimate when making permitting decision.

In this section we develop a fatality prediction for the West Butte Wind Power Project using data provided by the project proponent and using the FWS exposure-based fatality prediction model.

Methods

We used the large-plot, avian-use survey data provided in Gerhardt et al. (2008) and the exposure-based model in the ECPG (USFWS 2011) updated to a Bayesian framework to estimate an annual golden eagle fatality rate for the West Butte Wind Power Project. The sampling approach used by Gerhardt et al. (2008) differed in several respects from that suggested in FWS (2011), but the basic information (eagle detections per minute of observation) provide compatible inputs for the FWS's model. The most notable departure from the suggested approach in FWS (2011) was that data for the West Butte Wind Power Project were only collected over a single year, leaving uncertain how much annual variation in eagle use might occur in the project footprint. However, consistent with the FWS's commitment to be flexible in working with wind projects already in the planning stages when the ECPG was released (USFWS 2011: 8), we used the data available to estimate a fatality rate and confidence interval for the project.

There are two points that need to be made regarding how we used the Gerhardt et al. (2008) count data in these analyses. First, we assumed the single eagle detected was in the air in the sample space for $\leq$ 1 minute, and therefore only counted as 1 eagle exposure minute. Second, Gerhardt et al. (2008) noted that at some points, counts in the fall sample were made for 60 minutes (all other counts were 20 minutes). Observations made in the extra 40 minutes were not included in their summary totals (and no golden eagles were observed in the extra sample minutes). For these reasons we did not include them in our fatality prediction calculations.

We used an updated Bayesian version of the FWS's exposure model (USFWS 2011, as updated in Attachment 1) for calculation of the fatality prediction and credible intervals. The R (R Core Development Team 2008) script used to obtain the estimates is in Attachment2.

Results

Avian-use data for the West Butte Wind Power Project consisted of 4580 minutes (76 hours) of observations evenly spread across seasons over one year. There was one golden eagle detection within the count plots, which we counted as one eagle minute. From this sample, we estimated the mean number of flight minutes for golden eagles in the project footprint per hour per km^2 = 0.007, with a standard deviation (sd) = 0.006. These exposure parameter estimates yielded a fatality estimate of 0.39 golden eagles per year with an sd of 0.62 and upper 80%, 90%, and 95% credible interval limits of 0.56, 0.98, and 1.48 fatalities per year, respectively (Figure A3-1).

Conclusion

The fatality prediction for the West Butte Wind Power Project using the FWS exposure-based model is 0.4 golden eagles per year, with a 95% upper credible limit of 1.48. Thus, over the five-year term of the permit, the expected total number of golden eagle fatalities is 2, with a plausible range of between 0 and a 95% upper credible limit of 8 fatalities.

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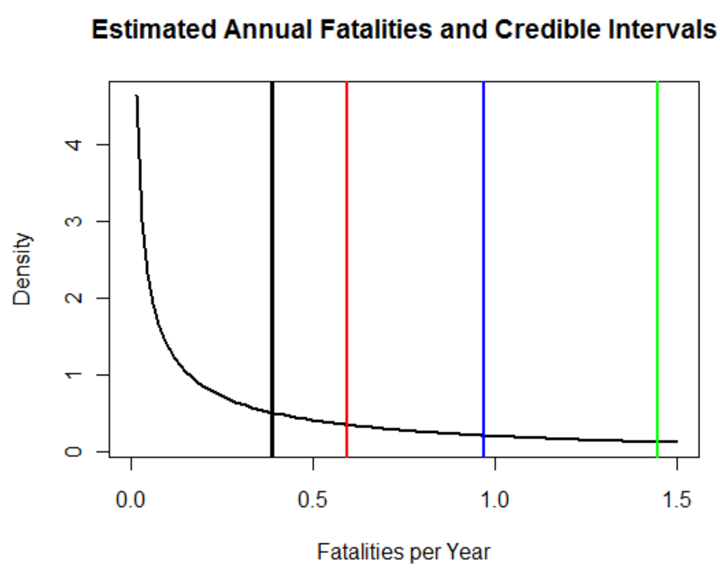

Figure A3- 1: Frequency distribution for the annual golden eagle fatality estimate for the West Butte Wind-Energy Project. The black reference line is the mean, the red line is the 80% upper credible limit, the blue line is the 90% upper credible limit, and the green line is the 95% upper credible limit.

A3-2 Eagle Inter-nest Distance Calculation

Background

The FWS considers the project-area nesting populations of both species of eagles carefully in programmatic eagle take permit decisions (USFWS 2011). If proximate nesting pairs of eagles are using the project footprint regularly, they could be at risk of collision with wind turbines. Because eagle nesting territories tend to persist for decades (Kochert et al. 2002, Buehler 2000), such a situation could result in repeated mortality of breeding adult eagles over many years.

In the ECPG, the FWS recommended using the species-specific mean inter-nest distance of the project-area nesting eagle population to identify territories that might be negatively affected by a wind facility. We conducted such an analysis for the West Butte Wind Energy project.

Methods

We followed the approach described in FWS (2011) for the project-area eagle nesting population assessment. We obtained bald and golden eagle nest site locations from a variety of recent and historic sources for the area within a 10-mile perimeter of the West Butte Wind Power Project footprint (data and sources are described in the West Butte Wind-Energy Project Environmental Assessment). We subjectively assigned nest locations to territories based on location, and we calculated the distance between closest neighboring nests (or the centroids of clusters of nests for territories depending on the years data were available) in a GIS. We then computed the mean and ½ mean inter-nest distances from the nearest-neighbor dataset for both species. We buffered each nest (or territory centroid) by mean and ½ mean inter-nest values to identify territories that potentially overlapped the project footprint. For the purposes of this analysis, we assumed the circle with a radius of ½ the mean inter-nest distance approximated the core use area of the resident eagles. However, we recognize that the utilization distribution of the resident eagles is not likely so uniform, particularly north of the project footprint where bald and golden eagles nests are associated with linear features along Bear Creek. Accordingly, given the uncertainty, we considered any territory within the mean inter-nest distance of the project footprint of interest.

Results

Available survey data indicate that five golden eagle territories and three bald eagle territories are likely present in the West Butte Wind Power Project area at the project-area population scale. The mean inter-nest distance for the bald eagle territories was 12,532 feet (3,820 meters, or 2.37 miles), and none of the territories overlapped the project footprint at either the mean or ½ mean inter-nest distances (Figure A3-2). Three golden eagle territories overlapped the project footprint at the mean inter-nest distance (40,574 feet (12,367 meters, or 7.68 miles), but only one overlapped at the ½ mean inter-nest distance of 20,287 feet (6183 meters or 3.84 miles). The most proximate golden eagle nest (the North nest) was omitted from this analysis as it was burned in a prescribed fire in 2009 and re-use is uncertain (see Section 3.3.2). Other previously used nest sites within that territory are considerably further away from the project footprint (the West nest, WN, was most recently active), but still within ½ the mean inter-nest distance.

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USFWS. 2011. Draft eagle conservation plan guidance. Available at: http://www.fws.gov/windenergy/docs/ECP_draft_guidance_2_10_final_clean_omb.pdf

Table A3- 1: Mean and ½ mean inter-nest distance (international feet) for bald and golden eagles in the project-area nesting population area for the West Butte Wind Power Project.

	Golden Eagle	Bald Eagle
Mean	**40,574**	**12,531**
1/2 Mean	**20,287**	**6,265**

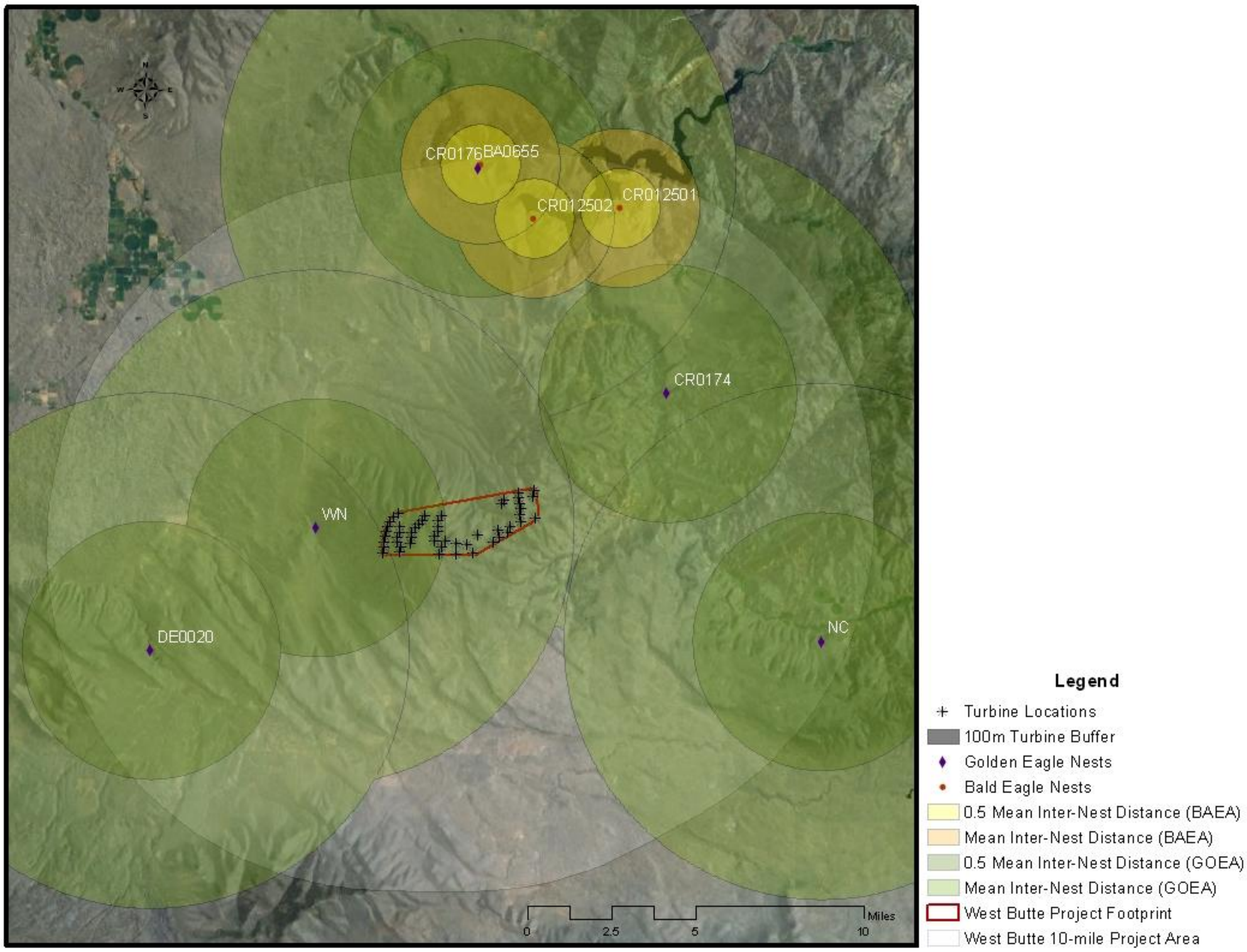

Figure A3- 2: Project-area nesting eagle population assessment.

A3-3 Predicted Fatality Estimation: Recommended Methods and Metrics

The Service uses a Bayesian method to predict the annual fatality rate for a project, using explicit models to define the relationship between eagle, collision probability, and fatalities, and to account for uncertainty. The relationships between eagle abundance, fatalities, and their interactions with factors influencing collision probability are still poorly understood and appear to vary widely depending on multiple site-specific factors. The baseline model presented below is a foundation for modeling fatality predictions from eagle exposure to wind turbine hazards. The model is intended to serve as a basis for learning and the exploration of other candidate models that attempt to better incorporate specific factors and complexity.

Variables used in the formulas below are summarized in Table A3-2 for ease of reference. The total annual eagle fatalities (F) as the result of collisions with wind turbines can be represented as the product of the rate of eagle exposure (λ) to turbine hazards, the probability that eagle exposure will result in a collision with a turbine (C), and an expansion factor (ε) that scales the resulting fatality rate to the parameter of interest, the annual predicted fatalities for the project.

$$F = \varepsilon \lambda C$$

Using the Bayesian estimation framework, we define prior distributions for exposure rate and collision probability; the expansion factor is a constant and therefore does not require a prior distribution. Next, we calculate the exposure posterior distribution from its prior and observed data. The expanded product of the posterior exposure distribution and collision probability yields the predicted fatalities.

Table A3- 2: Abbreviations and descriptions of variables used in the Service method for predicting annual eagle fatalities.

Abbreviation	Variable	Description
F	Fatalities	Annual eagle fatalities from turbine collisions
λ	Exposure rate	Eagle-minutes flying within the project footprint (in proximity to turbine hazards) per hr per km^2
C	Collision probability	The probability of an eagle colliding with a turbine given exposure
ε	Expansion factor	Product of daylight hours and total hazardous area (hr·km^2)
k	Eagle-minutes	Number of minutes that eagles were observed flying during survey counts
δ	Turbine hazardous area	Area within 2 times the rotor diameter of a turbine (km^2)
n	Trials	Number of trials for which events could have been observed (the number of hr·km^2 observed)
τ	Daylight hours	Total daylight hours (e.g. 4383 hr per year)
n_{tur}	Number of turbines	Number of turbines (or proposed turbines) for the project

1. Exposure

The exposure rate λ is the expected number of exposure events (eagle-minutes) per daylight hour per square kilometer (hr· km^2). We define the prior distribution for the exposure rate as:

$$Prior\ \lambda \sim Gamma\ \propto, \beta\ ,$$

where shape and rate are α = 0.13 and β = 0.25, respectively (mean, standard deviation: 0.52, 1.44). The prior λ distribution (Figure A3-3) was developed based on information from several projects currently under Service review and projects described in Whitfield (2009). The prior is largely uninformative and is meant to include the range of possible exposure rates for any project that might be considered.

Eagle exposure data collected during the pre-construction phase can be used to inform this prior. The Service may also be able to work with a project proponent on a case-by-case basis to use the prior λ distribution to generate a risk-averse fatality prediction for projects where no pre-construction survey data are available. Assuming the observed exposure minutes follow a Poisson distribution with rate λ, the resulting posterior λ distribution is:

$Posterior\ \lambda \sim Gamma\left(\alpha + \sum_{i=1}^{n} k_i , \beta + n\right)$, where n is hr·km^2 that were observed

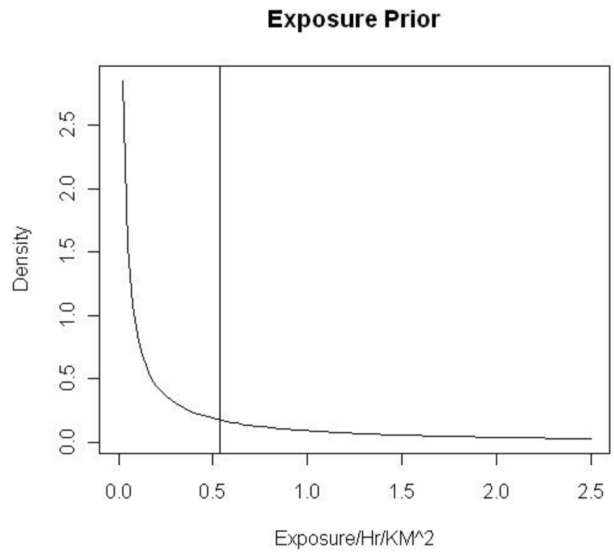

Figure A3- 3: Prior distribution (Gamma) for exposure rate, λ, with α=0.13 and β=0.25. The mean (indicated by the reference line) and standard deviation are 0.52 and 1.48, respectively.

The new posterior λ parameters are the sum of α from the prior and the events observed (eagle minutes, k_i), and the sum of β from the prior and the number of trials, n, for which events could have been observed (the number of “trials” is the number of km^2·hr that were observed). Note that with the inclusion of realistic time and area for eagle surveys, the impact of the prior λ on the resulting posterior λ distribution becomes negligible. The posterior λ can then be used to generate a prediction for annual exposure.

In addition, this posterior distribution can now serve as a prior distribution for the next iteration of the predictive model in an adaptive framework, at least for the project under consideration and potentially in a more general way as the posteriors from multiple sites are considered; in this way, we build ongoing information directly into the predictive process.

2. Collision probability

Collision probability, *C*, is the probability, given exposure, of an eagle colliding with a turbine; for the purposes of the model, all eagle collisions are considered fatal. We define the prior distribution for the collision probability as:

$$Prior\ C \sim Beta\ \ v, v'\ ,$$

where v and v′ are 1.2 and 176.7, and the mean and standard deviation are 0.0067, 0.0061, respectively (Figure A3-4). The prior *C* distribution was developed based on the mean weighted avoidance and range of avoidance rates estimated by Whitfield (2009) from 4 independent sites. The prior is meant to include the range of possible collision probabilities across the set of potential sites.

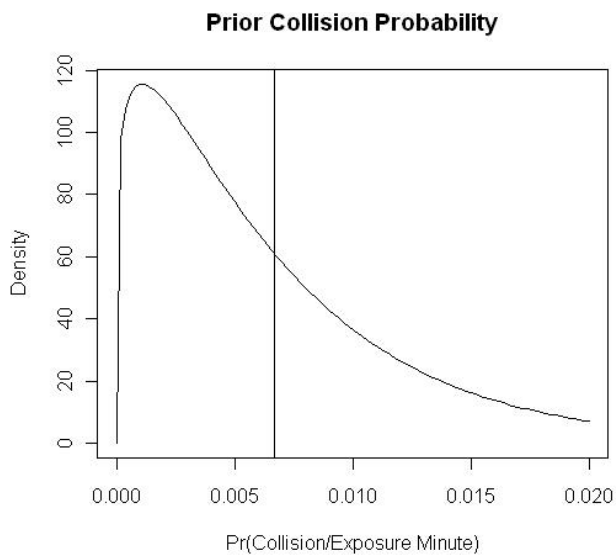

Figure A3- 4: Prior distribution for collision probability, C. The beta distribution has a mean (indicated by the reference line) of 0.0067 and a standard deviation of 0.0061.

At the time of pre-construction permitting, the prior distribution for *C* will be used in the fatality prediction. After construction, post-construction monitoring can be used to update the distribution of *C*.

Assuming the observations of fatalities follow a binomial distribution with rate *C*, the posterior distribution of the rate *C* will be a beta distribution (the beta distribution and the binomial distribution are a conjugate pair):

$$Posterior\ C \sim Beta\ \ v + f, v' + g$$

where *f* is the number of fatalities estimated from the Stage 5 post-construction monitoring, and *g* is the estimated number of exposure events that did *not* result in a fatality. The posterior distribution for *C* cannot be calculated until a project has been built, has started operations, and at least one season of post-construction monitoring has been completed. Once determined, the posterior *C* distribution can then be used to generate a prediction for annual fatalities and can serve as a prior *C* for the next iteration of the predictive model.

3. Expansion

The expansion factor (ε) scales the resulting fatality rate (fatalities per hr^{-} per km^2) to the daylight hours, τ, in 1 year (or other time period if calculating and combining fatalities for seasons or stratified areas) and total hazardous area (km^2) within the project footprint:

$$\varepsilon = \tau \sum_{i=1}^{n_t} \delta_i$$

where n_t is the number of turbines, and δ is circular area centered at the base of a turbine with a radius equal to 2 times the rotor diameter of the turbine (we define this as the hazardous area surrounding a turbine). The units for ε are hr· km^2 per year (or time period of interest).

4. Fatalities

Now we can generate the distribution of predicted annual fatalities as the expanded product of the posterior exposure rate and the prior collision probability (once post-construction data is available, the posterior collision probability would be used to update our fatality distribution).

$$F = \varepsilon \cdot posterior\ \lambda \cdot prior\ C$$

We can then determine the mean, standard deviation, and 90% quantile (this will be the upper credible limit) directly from the distribution of predicted fatalities.

5. Putting it all together: an example

The example below illustrates the calculation of predicted fatalities from exposure data from a project site. This data will normally come from the field surveys in Stage 2, but for the purposes of this example, we have generated fabricated observation data based on an annual fatality rate that we designated (2 fatalities per year). The advantage of simulating data in such an exercise is that the true parameter of interest (number of annual fatalities) is known and can be used to critically evaluate the performance of the model.

a. The example

Patuxent Power Company conducted surveys for eagles at a proposed location for a small to medium sized wind facility (18 turbines, each with a 0.05 km rotor diameter) following the

Table A3- 3: Example exposure data. In this hypothetical example, 168 counts were performed. Each count was 2-hr in duration and covered a 0.8 km radius circle.

Visit	P1	P2	P3	P4	P5	P6	P7	Total
1	0	0	2	0	2	0	1	5
2	0	0	1	0	0	0	1	2
3	0	1	2	0	0	0	1	4
4	0	1	0	0	0	1	1	3
5	0	1	0	1	0	1	1	4
6	0	0	1	1	0	0	1	3
7	0	1	0	0	0	1	1	3
8	0	0	0	0	0	1	0	1
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	1	0	1	1	0	0	0	3
12	0	1	0	0	1	0	0	2
13	0	0	1	0	0	0	1	2
14	2	0	0	0	0	0	2	4
15	0	0	0	2	2	0	1	5
16	0	0	0	1	0	0	0	1
17	0	0	0	2	0	0	0	2
18	1	0	1	1	0	0	0	3
19	0	0	0	1	0	2	0	3
20	0	0	2	0	1	0	0	3
21	0	0	0	0	1	0	0	1
22	1	0	0	0	0	0	1	2
23	1	0	0	3	0	0	0	4
24	0	0	0	0	0	0	0	0
Total	6	5	11	13	7	6	12	60

recommended methods in FWS (2011). They conducted 168 counts at 7 points and 60 eagle-min of exposure were observed (Table A3-3). Each count was 2-hr in duration, and covered a circle of radius 0.8 km. Thus, 675.6 km^2·hr were observed in total.

b. Exposure

The posterior distribution for the exposure rate is:

$\text{Posterior } \lambda \sim \text{Gamma } \alpha, \beta$,

where,

$$\alpha = \alpha + \sum_{i=1}^{n} k_i = 0.13 + 60 \; eagle\ minutes = 60.13 \; eagle\ minutes$$

$$\beta + n = 0.25 + 168 \; counts \times 2 \; hr \times \pi \; 0.8 \; km^{\;2} = 675.8 \; km^2 \cdot hr$$

(Remember that $Prior\ \lambda \sim gamma\ 0.13, 0.25$; Figure A3-3)

Thus, $Posterior\ \lambda \sim Gamma\ 60.13, 675.8$; Note the units for λ are per hr⁻ per km^2

The posterior distribution is shown in Figure A3-5. The mean and standard deviation are 0.09 and 0.01, respectively. Note that there is little influence of the prior on this posterior, because the sampling was substantial.

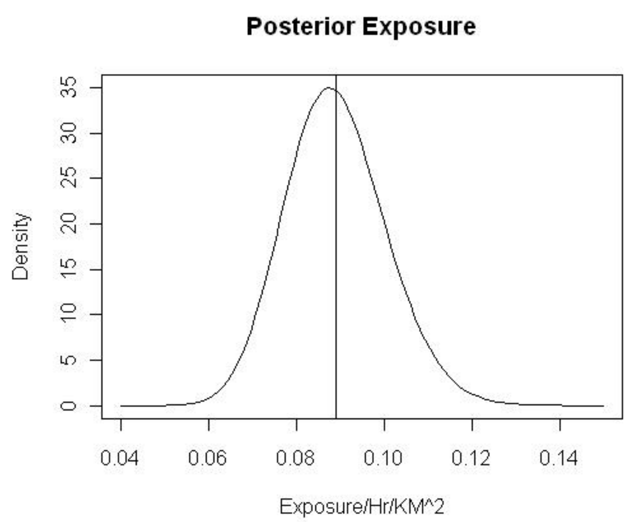

Figure A3- 5: The posterior distribution for exposure rate. This gamma distribution has a mean (indicated by the reference line) of 0.09 and a standard deviation of 0.01.

c. Collision Probability

We do not have any additional information about collision probability, *C*, so we will use the prior distribution, which has a mean of 0.0067 and a standard deviation of 0.0061.

$Prior\ C \sim Beta\ 1.2, 176.7$; see Figure A3-4.

d. Expansion

The expansion rate, ε, is the number of daylight hours in a year (τ) multiplied by the hazardous area (δ) around the 18 turbines proposed for the project:

$$\varepsilon = 4{,}383\ hr \cdot \pi\ \ 2 \times 0.05\ km\ \ ^{2} \cdot 18\ \ = 2{,}478.53\ hr \cdot km^{2}$$

e. Fatalities

To determine a distribution for the annual fatalities, the exposure and collision risk distributions need to be multiplied by each other and the expansion factor. The resulting distribution cannot be calculated in closed form; it is easiest to generate it through simulations. In this example, the predicted distribution for annual fatalities (Figure A3-6) has a mean of 1.46 and a standard deviation of 1.36. The upper 90% quantile is 3.2 eagle fatalities per year.

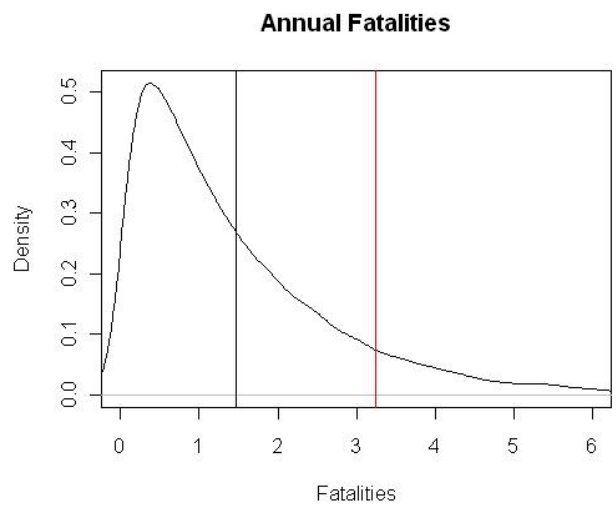

Figure A3- 6: The predicted distribution for annual fatalities. The mean (1.46) and 90% upper quantile (3.2) are represented by the reference lines (black and red, respectively). The standard deviation is 1.36.

The Service's baseline model for the proposed Patuxent wind facility predicts that 90% of the time that annual fatalities would be 3.2 eagles or fewer. The facility had a medium amount of eagle activity at the site, but the small size of the project kept the predicted fatality numbers lower than they would have been for a larger project in the same location. In this example, we know that the true mean fatalities are 2 per year which indeed falls with the 90% credible interval. Ideally, we would consider other candidate models alongside the baseline model presented in this here and compare their relative performance.

Literature Cited

Whitfield, D. P. 2009. Collision avoidance of golden eagles at wind farms under the 'Band' collision risk model. Report from Natural Research to Scottish Natural Heritage, Banchory, UK.

A3-4 R code (R Core Development Team 2010) used to generate golden eagle fatality estimates and credible intervals for the West Butte Wind-Energy Project.

```
## West Butte Fatality Estimation for EA - One stratum

# we will need to use simulations in the analysis, so first we
load the rv package and set the number of simulations to 10000
(other numbers of simulations may be used)

 require(rv) # loading the rv package##

 nSim<-10000 # assigning the value of 10000 to an object called
"nSim"##

 setnsims(nSim)  # sets the default number of simulations to the
value "nSim"##

 getnsims()  # getnsims retrieves the default number of
simulations##

# Survey Inputs; this is where we input the project details and
data from the preconstruction surveys

 CntRadiusKm<-800/1000 # point count radius in km

 CntKM2<-pi*(CntRadiusKm)^2 # point count area (does not have to
be a point count; could substitute any area estimate for
surveyed area)

 CntHr<-20/60  # count time in hours

## here we put the number of counts, eagle minutes, and total
daylight hours for each strata (in this case our strata are
seasons) into a data frame
```

```
 ExpSvy<-data.frame(row.names=c("Total"),
  nCnt=c(229),EMin=c(1),DaylightHr=c(4380))



 ExpSvy # we can look at the data frame


 nTurbine<-57 #the number of proposed turbines for the project

 TRadiusKm<-100/1000 #the turbine radius in kilometers (if there
are different sized turbines being used for the project, they
should be considered in separate calculations-e.g. treated as
strata)

 TBuffKm<-0 #the buffer distance added to the turbine blade to
account for the effect of turbulence

 HzKM2<-nTurbine*pi*(TRadiusKm+TBuffKm)^2 #this is the total
hazardous area for the project


# Expansion Factor


 ExpFactor<-ExpSvy$DaylightHr*HzKM2 #expansion factor, daylight
hours that we are expanding the exposure/collision to in the
model (we reference the DaylightHr in the ExpSvy dataframe)


## our Exposure rate prior is based on the exposure rates from a
range of other projects and is a gamma distribution with the
following mean, SD:

 PriExp  <-0.53

 PriExpSD<-1.478
```

```
# From the mean and sd, we get the shape and rate of the gamma distributed prior

 aPriExp<-(PriExp/PriExpSD)^2

 bPriExp<-PriExp/PriExpSD^2


## we can look at a graph of the exposure prior

   curve(dgamma(x,aPriExp,rate=bPriExp),0,2.5,

    main="Exposure Prior",xlab="Exposure/Hr/KM^2",ylab="Density")

   abline(v=aPriExp/bPriExp)


# now we update the exposure prior to get the posterior

  nTrials<-ExpSvy$nCnt*CntKM2*CntHr #the number of trials is the total km2-hours that we could have observed an eagle min ## I need to double-check the units here

  aPostExp<-aPriExp+ExpSvy$EMin #previous alpha + eagle mins observed (from the data frame)

  bPostExp<-bPriExp+nTrials #previous beta + number of trials


  Exp<-rvgamma(n=1,aPostExp,bPostExp) # this simulates the posterior exposure for each of the strata (samples a point from the proir adds the EMin and trials to get the posterior value and then does that 10000 times)

  summary(Exp)


## we can plot the posterior

   curve(dgamma(x,aPostExp,rate=bPostExp),0,0.04,

    main="Exposure Posterior",xlab="Exposure/Hr/KM^2",ylab="Density")
```

```
   abline(v=aPostExp/bPostExp)


# Collision Probability Prior based on the info in Whitfield
2009 gives:

  PriCPr<-0.0067

  PriCPrSD<-0.0061


 # Convert to the beta distribution a and b (nu and nu prime in
the appendix)

 Fac<-PriCPr*(1-PriCPr)/PriCPrSD^2-1 #formula for converting the
mean and SD into a and b

 aPriCPr<-PriCPr*Fac

 bPriCPr<-(1-PriCPr)*Fac


 # simulate the prior based on aPriCPr,bPriCPr

 CPr<-rvbeta(n=1,aPriCPr,bPriCPr); CPr


 ## for now, the prior is all we have for Collision Probability


 # Estimating fatalities


 Fatalities<-ExpFactor*Exp*CPr


 ##look at the annual fatality estimates for each strata

 ##80th quantile

 data.frame(Fatalities=rvmean(Fatalities),SD=rvsd(Fatalities),
```

```
UCI80=as.vector(rvquantile(Fatalities,probs=0.80)),UCI90=as.vect
or(rvquantile(Fatalities,probs=0.90)),

UCI95=as.vector(rvquantile(Fatalities,probs=0.95)),LCI95=as.vect
or(rvquantile(Fatalities,probs=0.05)) )



curve(dgamma(x,rvmean(Fatalities),rvsd(Fatalities)),0,1.5,main="
Estimated Annual Fatalities and Credible Intervals",

       xlab="Fatalities per Year" ,ylab="Density", lwd =2)

 abline(v=rvquantile(Fatalities,probs=0.80), col="red", lwd = 2)

 abline(v=rvquantile(Fatalities,probs=0.90), col="blue", lwd =
2)

 abline(v=rvquantile(Fatalities,probs=0.95), col="green", lwd =
2)

 abline(v=rvquantile(Fatalities,probs=0.05), col="green", lwd =
2)

 abline(v=rvmean(Fatalities), lwd = 3)


 sum(Fatalities) ##the overall annual fatality estimate
```

Appendix 4: Birds of Conservation Concern for Bird Conservation Regions 9 and 10

From:

USFWS. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at http://www.fws.gov/migratorybirds/]

BCR 9 (Great Basin) *BCC 2008* list

Greater Sage-Grouse (Columbia Basin DPS) (a)
Eared Grebe (nb)
Bald Eagle (b)
Ferruginous Hawk
Golden Eagle
Peregrine Falcon (b)
Yellow Rail
Snowy Plover (c)
Long-billed Curlew
Marbled Godwit (nb)
Yellow-billed Cuckoo (w. U.S. DPS) (a)
Flammulated Owl
Black Swift
Calliope Hummingbird
Lewis's Woodpecker
Williamson's Sapsucker
White-headed Woodpecker
Willow Flycatcher (c)
Loggerhead Shrike
Pinyon Jay
Sage Thrasher
Virginia's Warbler
Green-tailed Towhee
Brewer's Sparrow
Black-chinned Sparrow
Sage Sparrow
Tricolored Blackbird
Black Rosy-Finch

(a) ESA candidate, (b) ESA delisted, (c) non-listed subspecies or population of Threatened or Endangered species, (d) MBTA protection uncertain or lacking, (nb) non-breeding in this BCR

BCR 10 (Northern Rockies U.S. portion only) *BCC 2008* list

Bald Eagle (b)
Swainson's Hawk
Ferruginous Hawk
Peregrine Falcon (b)
Upland Sandpiper
Long-billed Curlew
Yellow-billed Cuckoo (w. U.S. DPS) (a)
Flammulated Owl
Black Swift
Calliope Hummingbird
Lewis's Woodpecker
Williamson's Sapsucker
White-headed Woodpecker
Olive-sided Flycatcher
Willow Flycatcher (c)
Loggerhead Shrike
Sage Thrasher
Brewer's Sparrow
Sage Sparrow
McCown's Longspur
Black Rosy-Finch
Cassin's Finch

10 (a) ESA candidate, (b) ESA delisted, (c) non-listed subspecies or population of Threatened or Endangered species, (d) MBTA protection uncertain or lacking, (nb) non-breeding in this BCR